ILLUSTRATED
ELECTRICAL REVIEW
A Journal of Scientific and Electrical Progress.

VOL. 22. No. 2. WEEKLY. | NEW YORK, SATURDAY, MARCH 4, 1893. | $3 per Annum. Single Copies, 10 Cents.

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Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

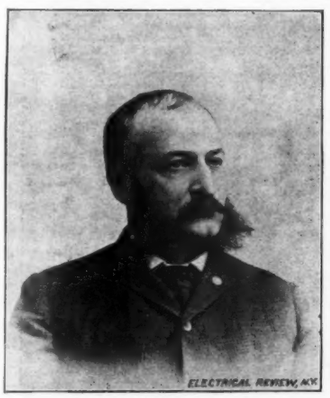
It was once asserted by a well known and wise writer that "Sum people's feelins cums hi." How is this for an example? A Minnesota politician has sued the Western Union Telegraph Company for $100,000, for having delivered to him on the day of his defeat a jeering message, to-wit: "Slippery Sam, your name is pants." Try, dear reader, to conceive the feelings of a disappointed politician upon being told that his name had been changed, and, moreover, such a change. No doubt this effort to have the courts brand "pants" as an opprobrious word will be indorsed by the ultra-cultured, but what do the Western Union people think about it?

The "Campania" and "Lucania," the two new ships now in course of construction for the Cunard line, will be the largest and finest vessels afloat when they are completed. Each is 620 feet long over all, with a beam of 65.7 feet, while the displacement is expected to be 18,000 tons. Everything known to the art of ship building which will add to the comfort and luxury of sea travelers will be installed. The electrical equipment will be very complete. Steam will be supplied to the engines for the electric plant of each vessel from an independent single-ended boiler. Over 40 miles of wire will be used in the lighting circuits of each ship, and light will be furnished by 1,350 sixteen candle-power lamps. Each vessel will also be equipped with a powerful search-light.

The Ohio legislature is debating whether it shall do its voting by electricity. What next? Still the introduction of a little lightning into that and a good many other State legislatures might be beneficial.

A clever application of the electrical current has been made in France. At an exposition in Paris an instrument for measuring electrically the exact degree of acidity of any solution was shown. Two plates were placed in a trough, through which acidulated malt was passed, connecting with a delicate ampere meter, and the reading on the instrument was a correct record of the degree of acidity. An alarm bell was arranged to ring at either of the extreme allowable limits.

The statistics lately compiled by D. Jenesco, concerning the conditions under which trees are most likely to be struck by lightning, are of great interest. It was for a long time supposed that certain kinds of trees were particularly subject to destruction by lightning, while others were quite free from danger. Among the first was the oak, and among the latter was the laurel. Mr. Jenesco now finds that at very high potential electrical discharges all kinds of trees are subject to destruction from lightning. Trees containing oils are less liable to be struck; those containing very much oil being protected the most. Lightning appears to prefer those trees which contain starch, and also those which contain oil to a slight degree only in summer. The quantity of water contained in the tree has no effect on its liability to be struck. Dead limbs of trees containing starch, as well as of those containing oil, are particularly likely to be struck. Cambium bark and leaves do not alter the conductivity of trees. The nature of the soil has no connection with the frequency of destruction of trees by lightning.



MAJOR J. B. HARLOW, POSTMASTER AT ST. LOUIS—ORIGINATOR OF ELECTRIC RAILWAY MAIL SERVICE.

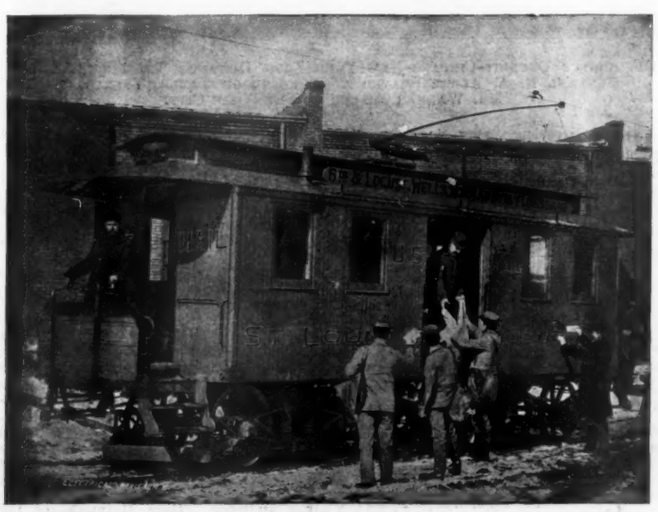
The Thomson Electric Welding Company has just purchased the patents of the Lombard electric loom, which it is said will make a saving of 10 per cent. in labor and will turn out better work than the looms now in use.

THE ELECTRICAL SPECIAL.

DELEGATES TO THE N. E. L. A. CONVENTION BEGIN THEIR JOURNEY TO ST. LOUIS IN A SPECIAL TRAIN OVER THE GREAT PENNSYLVANIA RAILROAD SYSTEM.

On Sunday, February 26, at 12.18 P. M., the Electrical Special pulled out of the Pennsylvania Railroad station at Jersey City. The delegates to the electric light convention at St. Louis were especially favored by the weather prophets, as Sunday proved to be one of the most delightful days of the winter. A handsome train, consisting of one of the Pennsylvania Railroad's elegant combination cars and four palace sleepers, afforded accommodations for the travelers, who were placed in charge of the genial Mr. Hames, one of the Pennsylvania's most efficient and popular officers. Master of Transportation C. O. Baker, Jr., had all arrangements carefully made, and the trip was commenced in a jolly mood. The passenger list follows:

NEW YORK—George J. Jackson, Herbert Laws Webb, H. M. Swetland, A. B. Laurence, W. J. Johnston, Augustus Noll, C. W. Price, H. T. Richards, R. B. Corey and guest, H. C. Adams, E. E. Wood, P. C. Ackerman, B. R. Western, Nelson W. Perry, Fremont Wilson, John A. Seely, C. O. Baker, E. W. Seymour, F. A. Magee, W. S. Key, J. C. Pierrez, B. E. Greene, F. M. Pierce, W. F. Osborne, H. M. Haines, Nikola Tesla, Geo. M. Phelps, T. C. Martin, F. R. Colvin, H. C. Myers, Wm. J. Hammer, A. H. Bower, G. T. Manson, Mrs. Manson, H. J. Smith, J. B. Taltavall, J. P. McQuaide, Louis Cassier, Mrs. Cassier. RUTLAND, VT.—Mr. and Mrs. M. J. Francisco. PHILADELPHIA—A. H. Manwarren, Mrs. Manwarren, James A. Pentz, T. Carpenter Smith, A. J. De Camp, Mrs. De Camp, Miss De Camp, Miss Cumming, A. J. Martin, H. B. Cutter, Heisler Company (2 Representatives). PITTSBURGH, PA.—E. H. Heinrich, M. Coster, M. W. Mead. BROOKLYN, N. Y.—E. F. Peck, James Ferguson, T. E. Crossman, F. H. Mason. BRIDGEPORT—C. E. Carpenter, W. C. Bryant. BIRMINGHAM, CONN.—R. E. Wyant. NEWARK, N. J.—R. O. Heinrich, C. McIntire, Wilson S. Howell. WORCESTER, MASS.—H. H. Fairbanks. BOSTON, MASS.—DR. Louis Bell, J. H. Mason, C. S. Haley. WARREN, O.—W. B. Packard. TROY, N. Y.—E. G. Bernard. WASHINGTON, D. C.—F. W. Royce. SEWICKLEY, P. A.—E. P. Young. SYRACUSE, N. Y.—W. J. Morrison. LONDON, ENG.—Prof. Geo. Forbes. BRUNSWICK, N. J.—A. J. Jones. CLEVELAND, OHIO.—E. P. Roberts, Fred. A. Shefler. WINDSOR, CONN.—A. D. Newton, M. E. Baird. HARTFORD, CONN.—C. E. Newton, E. B. Hatch. SEATTLE, WASH.—E. C. Kilbourne. NEW BRITAIN, CONN.—L. C. Whitney.



ELECTRIC RAILWAY MAIL CAR ON THE ST. LOUIS & SUBURBAN ROAD, ST. LOUIS.

The Electric Railway Mail Service at St. Louis.

THE TROLLEY SYSTEM A VALUABLE AID TO THE POSTAL SERVICE—DESCRIPTION OF THE PLAN OF OPERATION.

BY MAJOR JOHN B. HARLOW, POSTMASTER.

One of the problems to which the United States Post-office Department has probably devoted more time and thought than to almost any other, is the prompt delivery of local mails. To the average American, it has often seemed a curious thing that a piece of mail matter dropped in the post-office at St. Louis, for instance, is delivered at the correct address in Chicago, say, sooner than a similar piece of mail matter mailed at the same time and place is delivered in the residence portion of St. Louis. The chief reason for this is that the Chicago mail is traveling in a railway car at night, while the local mail for St. Louis is lying dormant in the St. Louis post-office waiting for a carrier to make his rounds the following morning.

This problem of rapid local delivery has been uppermost in the minds of the St. Louis post-office authorities for several years and it finally occurred to me, about three years ago, that the cable lines and the then new trolley lines of St. Louis could be made available to at least assist the St. Louis post-office in the rapid delivery of local mail. The idea took the form of a hobby and as I have been at various times connected with nearly all the branches of the postal service, I brought to bear upon the subject all the information and experience at my command. I finally decided that the keynote had been struck, and in March, 1891, I brought before the post-office department a plan for an electric railway postal service in St. Louis, which has since been carried out with great success.

After a conference with President Charles H. Turner, of the St. Louis and Suburban Street Railway Company, a trolley car used for the transportation of baggage and freight was placed at my disposal and was fitted up by the street railway company as a railway mail car on a diminutive scale. This car is 28 feet long over all and 8½ feet wide, with front and rear platforms and double rolling doors in the middle of each side. It is fitted with two four-wheel passenger trucks and is capable of a maximum speed of 25 miles per hour. In one end, on the right hand side, is a rack for mail bags and opposite this is a set of pigeon holes for distributing mail, and a table on which the canceling of mail is done. The working force of this car includes a senior and a junior post-office clerk, a motorneer and a conductor. No passengers are carried, but beyond a certain point the street railway is allowed to carry light freight, which is transported in this car. The longest run is from the vicinity of the post-office, in St. Louis, to a point 18 miles away, which is

11½ miles beyond the city lines. The territory which receives the benefits of this rapid mail service is about one-sixth of the city area, and with a few more extensions of the service, the whole of St. Louis can readily be covered. The first trip made by this car for the delivery and collection of local mail was on December 5, 1892, although previous to this street cars had been used for the carrying of closed mails to suburban post-offices outside of the city line.

This car makes three trips per day and handles in round figures about 20,000 pieces of mail per day. The local service has been improved to the extent that at least four hours is saved in the delivery of mail and in many cases the service is much quicker than the sending and delivery of a telegram. The method of working is about as follows:

The car leaves the post-office on its first trip at 6.25 A. M. It carries the closed mail for suburban points on the line of the road beyond St. Louis, and also the local mails which are dropped at the several rallying points and sub-post-offices as the car proceeds. The carriers have timed their rounds so that they have made a delivery and a collection of mail, and are waiting at the rally-point when the car arrives. Mail intended for a certain carrier's route is placed in a bag, and as the car stops it is handed to him while he passes over, in return, the mail which he has collected and assorted on his last trip. If there happens to be any mail in his collection which is to be delivered on his route, these pieces are immediately canceled and handed back to him at once. Thus it is possible that mail which is dropped in a street box, and intended for delivery on the same route, often reaches the receiver within 15 or 20 minutes of the time it is mailed. The package of mail which the carrier has handed in is rapidly assorted, and by the time the next stop is made has been classified, so that if any is meant for the next carrier met, it is canceled and handed to him as the car stops. The larger part of the mail, however, is placed in bags, and when the end of the route is reached the junior mail clerk takes this mail, jumps on a passenger car and returns with it to the post-office, where it is again sorted, the out-of-town mail being separated from the rest.

The electric railway mail car runs on the time of the preceding passenger car, and as the headway on the St. Louis & Suburban road is about two and a half minutes, ample time is afforded for the collection and dropping of mails. The mail car has the advantage of the passenger car in that it makes fewer stops, because it carries no passengers and it very seldom delays the following car.

This electric railway innovation affords the post-office department an opportunity to improve the sub-station service, which has an important bearing on local mail delivery. On the present line there are now three sub-stations, and three more have been decided upon, making six sub-stations in six miles between the St. Louis post-office and the city limits, where the public can transact all manner of post office business. At all these sub-stations money orders can be purchased and cashed and mail matter may be registered.

It has been demonstrated that in densely populated cities covering a large territory that the custom of having but one large central post-office with only a few stations has outlived its usefulness. It is now consonant with other advanced ideas regarding municipal service to have numerous sub-post-offices where all postal conveniences can be had in each business and residence center. Then an electric railway mail service connecting these sub-stations will afford an up-to-date local delivery service.

It is intended to eventually extend the present St. Louis urban distribution of mails on the electric railway plan to the suburban post-offices lying beyond the city limits on the line of the St. Louis and Suburban Street Railway Company which now receive only the benefits of a closed or regular railway mail service. Thus a perfect local distribution of mail, including the celerity and dispatch which have made the electric railway mail service so popular and valuable, will be participated in by every country post-office on or near the St. Louis and Suburban road for a distance of 18 miles from the St. Louis post-office.

The public is slow, as a rule, to appreciate innovations of this character, but the daily increasing amount of mail carried shows that this service is meeting with unusual popularity. The real estate man has found an important and convincing argument in this service. It has been found that where a man is contemplating building a suburban home, he will endeavor to locate in the vicinity of a trolley road, and then if he finds that a mail service, which is very often as quick as the telegraph, is operating on this trolley road, it does not take him long to decide upon the location of his home.

While this service is operating very satisfactorily, there is no doubt that time will show where changes may be made to advantage and they will be promptly followed as experience may suggest. At present St. Louis, which is an electrical city of greater importance than many persons imagine, is the only city in the United States which is availing itself of the advantages of the electric railway for the rapid delivery of local mails.

OPENING OF DETROIT-CHICAGO-NEW YORK LONG DISTANCE TELEPHONE LINE.—GENERAL R. A. ALGER SEATED AT THE END OF TABLE, TALKING TO MR. WARNER MILLER IN NEW YORK CITY.

A 6,000 Foot Span of Wire.

The longest single span of wire in the world is used for a telegraph line, and is stretched over the river Kistuah, between Bezorah and Sectanazoum, India. It is over 6,000 feet long, and is stretched from the top of one mountain to another.

A Telephone for An Audience.

Pope's Theater in St. Louis possesses one convenience which could be adopted with profit by all other similar places of amusement. In inaugurating the season of 1892-3, the management of this theater has given the purchasers of its seats telephonic communication, enabling those attending the performances to be called quickly in case of necessity. By leaving their seat numbers in the box office they can be called immediately.

Detroit Talks to New York, Chicago and Pittsburgh.

On Saturday, February 18, the city of Detroit, Mich., was brought into the chain of long distance telephone stations. The opening ceremonies were held in the Campau building, Detroit, where ex-Governor Russell A. Alger sat and conversed with ex-Senator Warner Miller in the Fifth Avenue Hotel, New York.

Mr. Wendell Baker, contracting agent for the Long Distance Company, called up Mr. H. G. Bates, at 18 Cortlandt street, New York, and then the following conversation, as reported in the Detroit *Free Press*, ensued between Mayor Pingree and Mr. Bates:

Mayor—"How are you, sir?"

Bates—"Pretty well, thank you; who are you, please?"

Mayor—"I am the mayor of this city. How is the weather in New York?"

Bates—"We are just getting through with a blizzard that rivals that of 1888. The snow is two feet deep on the level."

Pingree—"We have had heavy snow lately, too, but nothing to compare with that."

Bates—"How do you hear me?"

Pingree—"Very well, indeed. Can you hear me distinctly?"

Bates—"Yes; every word you say."

Pingree—"Allow me to congratulate and thank you, on behalf of the citizens of Detroit, on this great achievement which brings us closer to our fellow men."

Bates—"Thank you, Mr. Mayor. Good-bye."

Pingree—"Good-bye, and good luck to you."

Senator Warner Miller was at the Fifth Avenue Hotel, feeling unwell, but the hotel was switched to the main line, and General Alger and Mr. Miller had quite a confab. Mr. Miller was diplomatic in his answers; he said the Nicaragua Canal scheme was doing nicely, remarked that he probably would not attend Cleveland's inaugural, and said good-bye. Later Pittsburgh and Chicago were in turn switched on. In the latter city De Wolf Hopper sang "The Adolescent Dog," and recited "Casey at the Bat," to the unbounded pleasure of his Detroit audience. Burr McIntosh, of the Palmer Company, recited "Surrender," and F. L. Grannis played the banjo from Chicago, and the exhibition closed.

A large number of prominent Detroiters were present at the opening, as were also Stoughton Walker, district superintendent of the Long Distance Company, Edward D. Trowbridge, manager at Detroit, Albert F. Allen, technical expert, and Hugo Neilson, superintendent of the Long Distance lines in Canada.

LIGHT AND POWER STATIONS.

SOME HINTS TO OWNERS AND OPERATORS BY A PRACTICAL ENGINEER.

Service Connections—Use Good Wire—Glass Insulators The Proper Thing—Avoid The Use of "Jumpers"—Plenty of Fuses With Transformers.

BY ROBB MACKIE.

XIV.

From the point where the wires branch from the pole line for "service connections" even greater precautions should be taken than on the pole line itself to have the work done in the best possible manner, for it is upon these service lines, running as they do along fronts of buildings, around awnings, through walls, etc., etc., that there is more likelihood of "grounds," "crosses," and the other difficulties summed up by the station man under the general head of "trouble," than upon any other part of the lines. Therefore, the materials used in making these service lines should be of the very best, and, if put up in a substantial manner, one cause, at least, that tends to interruption of the service will be eliminated. Even if the arc lines have been put up on the poles with no better insulation than a good grade of weatherproof wire the "service" should invariably be made with only the best grade of rubber covered wire. This should be tapped on *at the break arm*, where the main line is opened for the "service," and then run to the nearest point on the building in or on which the lamps are to be located. At this point the wires should enter a "dead loop" cut-out placed in a conspicuous position accessible to firemen or other authorized persons.

From the cut-out the same grade of wire should be continued throughout this loop circuit, whether the lamp be located inside or outside the building.

These wires should be rigidly supported upon strong brackets that will maintain them at least three inches from all surfaces, with at least eight inches between the positive and negative wires. All attachments should be made to *glass* insulators, so put up as to readily shed the rain.

Where wire enters a building, extra insulation should be used in all cases, and "drips" arranged to prevent water running down the wire and leaking into the building through the tubing.

In stringing wire along the ceiling of the room, it will be found that a much better piece of work can be done if the insulators are secured to hardwood blocks of a sufficient size to enable fastening them to the ceiling with at least four screws, or by the use of specially designed iron supports for the insulators. Either of these gives a much firmer support for the wire and permits it being drawn up in a much tighter and more sightly manner than if the insulators are only attached to the ceiling by one screw, as has been customary.

Arc lamps should invariably be supported by a hanger board provided with a "dead loop" cut-out or other device which will permit the removal of the lamp in case of necessity from a line circuit without the use of that dangerous device, the "jumper."

Under no circumstances should an arc lamp be governed by a "strap switch," which simply shunts the current through a path of lower resistance than the lamp itself, but still leaves current passing through the working parts and carbons of the lamp. All switches should be so made that when the lamp is cut out all current is entirely cut off, the lamp allowing of its being handled with the greatest safety; then it can be removed from the circuit without danger of opening it, which admits the removal of and changing of the lamp if for any reason it is burning badly, without any danger to the attendant as long as the switch is thrown to the "off" point.

The practice in vogue in many places of

placing the "cut-outs" for individual service lines on the poles is a bad one, especially when several services run from the same pole. In case it is necessary to cut off the current promptly, much confusion is apt to result and valuable time be lost. It is best, therefore, to place the cut-outs for individual service lines upon the building where the lights are to be used, and whenever possible as near the point where the wires enter the building as possible when inside lamps are used.

Upon high potential motor circuits the same care should be exercised in regard to the running of service connections as prevails in arc work, only with these suitable fuses should be placed on the pole at the point of junction with the main line, and then a suitable double pole switch provided on the building to allow the current to be cut off from the outside in case of necessity.

Along all outside walls, and within buildings, these wires should be treated in same manner as arc wires, and great care should be exercised about the placing of the "starting box," which should be fire proof, and the motor connections in order to reduce the fire risk to a minimum.

The conditions governing alternating current circuits are such that a more lengthy discussion of them than of either of the foregoing is necessary.

In the first place, the greatest care should be exercised in the wiring inside the station, about the switchboard, etc., to have it in as nearly a perfect condition as is possible. Only the highest grades of insulation should be allowed, and the insulation of the apparatus within the station should be maintained at as high a point as is possible.

The lines should be put up of the best grade of rubber insulation, with at least two coverings of hard braid as an additional protection.

Whenever joints are made they should be thoroughly soldered and then insulated with a rubber insulation, and over this should be wound a hard tape, with the ends securely fastened to prevent unraveling.

Whenever possible, alternating current lines outside of a station should be carried on cross-arms devoted to this class of currents only, and even at the expense of placing additional cross-arms on poles this rule should be followed throughout the construction of a plant.

On long alternating current circuits and those running parallel for long distances care should be taken to so arrange the wires as to prevent inductive effects on adjacent lines, or, as some station men term this difficulty, "choking" or "fluttering," which is sometimes experienced on long lines of this class. By a little judicious crossing of the lines this trouble can be entirely overcome.

Whenever branch lines are taken off the system, or at the point of junction between the "feeders" and distribution mains, care should be taken to insert the proper fuse strips. These are of the greatest importance to the successful operation of a system of this character.

Whenever a service connection is attached to the mains, a fuse strip should be inserted in both legs of the loop. It makes no difference whether the transformer is provided with fuses within itself. The point is to protect the generator, and to have as little interruption to the general service as is possible. As this is a point often overlooked by the station superintendent, a few words of explanation will be in order.

The position is constantly taken that the fuses within the transformer afford all the protection necessary. This is erroneous. As long as the "cross," or "short circuit," or "trouble" is confined to the secondary line, or within the transformer case, this fuse *does* afford the desired protection, but there this protection ends. The clearest way to make this plain is by citing an example. Suppose, therefore, there is an alternating current distribution line on a street which is properly protected with fuses at its junction with the feeders; this line supplies 50 consumers, using about 400 lights on 20 twenty-light transformers, located on both sides of the street, with service lines from the poles, wherever necessary.

If reliance is placed on the fuses within the transformers only, and a strong wire falls over any pair of service lines throughout this street, the result is that the main fuses at the junction with the feeders "blow out," and every customer on this circuit is in darkness.

On the other hand, if each loop to a transformer or group of them is properly protected by fuses, and then each transformer in a group is also protected, there is no danger of more lights than those supplied by any particular loop being cut off unless by a short circuit of the main lines, and this is of very rare occurrence if lines are properly put up and looked after.

Observation will convince those interested that the greatest successes in the reliability of transformer service have been obtained by those managers who have followed this practice. There are a few objections urged against this, as some term it, "excessive use of fuses," but once let the fuses be properly put in and then carefully watched, and the result will be found to be extremely beneficial and convenient, for by the use of a combination fuse and switch any circuit can be temporarily disconnected in case of necessary repairs or alterations.

Attention is called to the necessity for careful selection of transformers with a view to the most economical distribution and the cutting down of the constant primary loss due to the current required to magnetize the iron core of the transformers.

Much has been written upon this subject of late that will repay the careful examination of the central station owner and superintendent, and lead to a reduction of losses that many of them little dream of, which are now a constant drain upon the profits of their stations. Two illustrations bearing on this subject will point a moral that will make a fitting close for this chapter.

One station that I had occasion to investigate showed an abnormal cost of production. A careful examination indicated that contract consumers were burning after midnight. An actual count of the lamps burning showed this was not a fact. A test of a bank of converters with open secondary circuits gave an indication of where the trouble lay.

A test was then arranged for with all the secondary circuits open, leaving the primary coils of the transformers connected on the

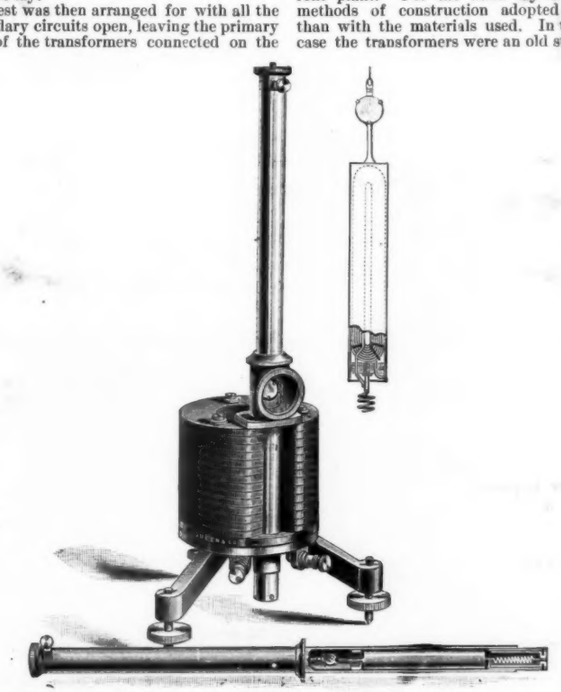


FIG. 2.

circuits. The generator was driven from a high speed engine and a series of indicator cards carefully taken. The result was simply astounding as it showed a *horse power* loss, not an indicated *current* loss, of nearly 20 per cent.

That is, after making all deductions for friction, etc., it was found that the horse power required to generate the current passing through the primary coils of these transformers with open secondaries was nearly 20 per cent. of the power required to generate the current when the heaviest loads of the day were on. As this test was made on a circuit on which over 2,000 lights were connected, it is clearly seen that the quantities were not so small as to allow of any very material error from "small readings."

The other case was where a large number of small transformers were used to supply 10 and 15 lights to each customer. In many cases these were put up over stores immediately adjoining, in each case a transformer was used for each customer. A

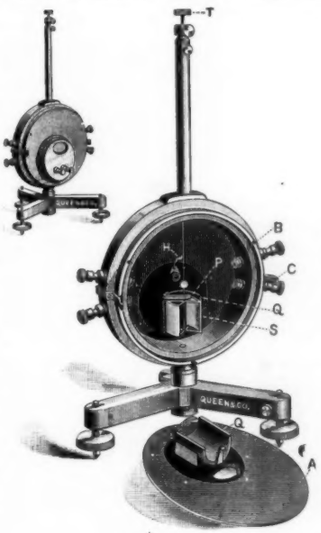


FIG. 1.

careful test of a bank of transformers at the station showed that the actual loss on the lines connected with this station were over 60 amperes.

When it is calculated what revenue this represented, it will easily be understood that it required no very close calculation to prove to the owners that rather than to continue operating at this loss, it was cheaper to change their transformers for larger ones and to run secondary distribution mains, even if they could not dispose of the smaller transformers. Do not let these instances of poor engineering discourage the purchase of an alternating current plant. For the fault lay with the methods of construction adopted rather than with the materials used. In the first case the transformers were an old style put up in the earlier days of the introduction of the alternating current system, before the economies were as carefully studied as they are to-day.

These illustrations will serve to call the attention of the station owner and operator to the necessity of actual and accurate knowledge on his part in the erection of a plant, and it is to be hoped may open the eyes of some to the necessity for a change that will reduce their operating expenses, and thereby increase the profits even if it does call for a present cash expenditure to buy new and more economical transformers, with which to replace the old ones now in use, which are so fast eating up the legitimate profits.

New Queen Measuring Instruments of Precision.

Queen & Company, incorporated, of Philadelphia, have recently put upon the market some electrical measuring instruments so original in design and efficient in use as to call for special mention.

Fig. 1 shows a new form of D'Arsonval galvanometer. The magnet is horizontal, circular in form, and built up of a number of disks stamped from sheet steel. The pole faces are shaped so as to give readings on a straight scale exactly proportional to the currents measured. The coil is long, narrow and circular in cross-section, and is fastened in an aluminum tube, which forms part of the movable system. No iron core is used. The suspension tube is fitted with a movable bottom, which, when raised, lifts the coil so as to relieve the suspension, and clamps it tight. This prevents any injury during transportation. The whole suspension tube can be lifted out and replaced by another, automatic sliding contacts being made as the tube is put in position. To use the instrument all that is necessary is to lower the bottom gently and relieve the coil. The mirror is so arranged that the axis of rotation lies in the center of reflecting plane, and the window of the mirror cage is tilted to prevent reflection from its surface. The instrument is sensitive to a high degree, and being absolutely uninfluenced by strong and varying fields or mechanical vibrations, gives as accurate results when used in a dynamo room as when used on a brick pier in a laboratory. It, therefore, extends the range of usefulness of a highly sensitive galvanometer far beyond anything yet reached. For general use the motion is made absolutely dead-beat, so as to obviate the necessity of using "tapper keys," and to save an enormous amount of time, which is very important when rapid and exact work is demanded. This should recommend it to central station men as well as to professors. Tubes are also made for ballistic work in which the damping effects is lessoned, and in this connection a bifilar suspension has been used. With two suspensions of .0015 inch phosphor-bronze strip 20 inches long and $\frac{3}{16}$ of an inch apart, and a coil of 703 turns of No. 40 copper wire, whose resistance is 450 ohms, a throw of 25½ centimetres with 1 microfarad and 1 Carbart cell, and a period of 10 seconds was obtained. When used as a ballistic galvanometer, the coil on being thrown to the end of the scale, may, in every case, be brought completely to rest in from 12 to 15 seconds by merely short circuiting. The instrument can also be used for thermal work, and with a suspension of phosphor-bronze strip rolled from .002 inch round wire, spring .0025 inch platinum silver, coil 275 turns of No. 32 copper wire, with a resistance of 25 ohms, and junctions having a value of .00004 volts per degree C. change, a deflection of 1.9 centimetres per degree change was obtained. It is certainly a very remarkable instrument.

Fig. 2 represents the Ryan electrometer. This instrument was designed by Prof. Harris J. Ryan, of Cornell University, for measuring potential difference either direct or alternating. The quadrants, four in number, are mounted on two quartz disks, set on the inside of two metal cover plates that protect the system, and are faced with mica to prevent short circuiting should the needle happen to touch them. The needle is cylindrical in shape and can be hung with either quartz or silk suspension. It is situated exactly in the center of the cover case, and just above it is fastened the mirror whose silvered surface contains the axis of rotation. The cover case is made of two parts symmetrically disposed with respect to the system, and held in position by a spring clip. In this way both parts, each carrying a pair of quadrants, can be lifted from the frame so that the needle may be inspected. Three little pegs over which each half of the cover plate fits insure their returning to the same relative position. Opposite quadrants are rigidly connected by metal strips.

On the circumference of the cover case, and symmetrically disposed with respect to the system, are two wound coils, one of coarse and the other of fine wire. These enable the instrument to be used in two ways. Either the electromotive force may be calculated from the deflection it produces, this being measured by a scale and telescope, or else a zero method may be used, in which the needle is brought back to zero, after being deflected by the action of a current passed through the wound coils mentioned above, and the electromotive force calculated from the magnitude of this current. This latter has the advantage of giving results unaffected by changes in the earth's field. The instrument can be used with equal success on direct and alternating circuits, as the instrument takes no current and has no induction to be corrected for. It takes up very little room, is strong in make, and recommends itself as much for commercial as for laboratory work. It is especially advantageous in determining the efficiency of transformers by "three electrometer reading" method.

A Great Manufacturing Company.

THE WORKS OF THE EDDY ELECTRIC MANUFACTURING COMPANY AT WINDSOR, CONN.

The works of the Eddy Electric Manufacturing Company, some views of which are presented herewith, are located in the little town of Windsor, Conn., on the line of the N. Y., N. H. & H. R. R., and within a few minutes' ride of Hartford, and rank as the leading industrial enterprise of that section.

A few words relative to the history of the Eddy Company will prove interesting as an example of the possibilities held out by the electrical field to the young men of the country, and how much can be accomplished in a comparatively short length of time even from a very modest beginning.

Mr. A. H. Eddy, the founder and president of the company, is a man of only 35 years of age, and all those associated with him are remarkably young in years, although, as results can testify, old in experience and well grounded in the qualifications necessary to the make-up of the successful business man of the period.

In 1881, Mr. Eddy, having served his apprenticeship in the works of the Harris-Corliss Engine Company, at Providence, and having there acquired a pretty solid mechanical education, became interested in the subject of electroplating and electrotyping, and started the manufacture of dynamo-electric machines for this purpose under a license of the Mather patents. He opened a small shop at 68 Market street, Hartford, and for some time handled the business entirely alone, manufacturing the machines himself and selling them as fast as he could turn them out.

In 1885 the business had increased very largely, and in October of that year the present company was organized. New quarters were taken at 42 Union Place, and, in addition to the plating machines, the manufacture of motors and generators was taken up. After two years of prosperous business it was found necessary to have increased facilities, and with this end in view a site was purchased at Windsor, directly on the line of the railroad, and a plant erected.

The original building had a frontage of 145 feet and a depth of 50 feet, but as business still continued to improve even this space was found to be inadequate, and last spring another building, 154x50 feet, was added, giving a total frontage of 300 feet. The offices are still considerably crowded, and plans for a new office building are now under way.

On entering the machine shop, the first objects which meet the eye are two massive planers, used for planing the heaviest castings. The first and largest of these special tools weighs about 24 tons. It has a 14 foot bed and a planing surface of 60x60 inches. The other has a capacity of 42x48 inches and a 12 foot bed. Both of them are in use day and night, and at present are at work on the castings of the four 250 horse-power six-pole generators which the Eddy Company are making to furnish power at the World's Fair. These machines when completed will weigh 12 tons each.

Between the two planers is a Warren radial drill with a six foot arm, used for drilling the heavy castings, and in the rear of this is a boring mill made especially for boring out the field magnets of the smaller sizes of machines. It has a sweep of 26 inches in the clear.

The rest of the machine shop is occupied by about 30 different styles of machines, among which are several special tools. Probably the most valuable of them is a 36 inch automatic gear cutting machine. Next in order comes the winding department for large armatures which are too heavy to be carried up stairs, and opposite this is the tool room.

The balance of the first floor is devoted to the testing and assembling departments. The testing department is an especially interesting feature, having a capacity for testing 30 machines at one time, and here can be seen all the various sizes, ranging from one-half to 100 horse-power in two-pole, and up to 180 horse-power in multipolar machines.

Among the interesting objects on this floor were two transformers of 50 horse-power each and one 100 horse-power alternator ready for shipment to the Electric Forging Company, of Boston. In a test of one of these transformers in connection with a 50 horse-power machine, a bar of iron one and one half inches in diameter was brought to a white heat in less than 30 seconds. When backed by the 100 horse-power machine designed to go with them, even better results can be obtained.

Power is supplied by two engines, the largest of which, a 250 horse-power tandem compound of the Ball type, is situated on the ground floor in the center of the building. Adjoining this is the boiler room containing a 250 horse-power Roberts boiler fed

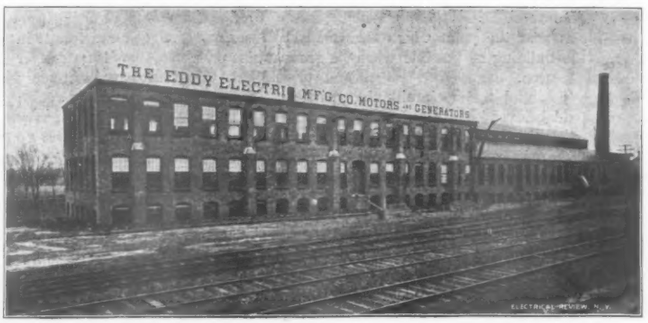


FIG. 1.—VIEW OF EXTERIOR OF FACTORY OF THE EDDY ELECTRIC MANUFACTURING COMPANY AT WINDSOR, CONN.

FIG. 2.—SPOOL WINDING ROOM, EDDY COMPANY.

FIG. 3.—ARTHUR D. NEWTON, A. H. EDDY AND M. E. BAIRD, SECRETARY AND TREASURER, PRESIDENT, AND GENERAL AGENT, RESPECTIVELY, OF THE EDDY COMPANY.

FIG. 4.—ASSEMBLING AND TESTING DEPARTMENT, EDDY COMPANY.

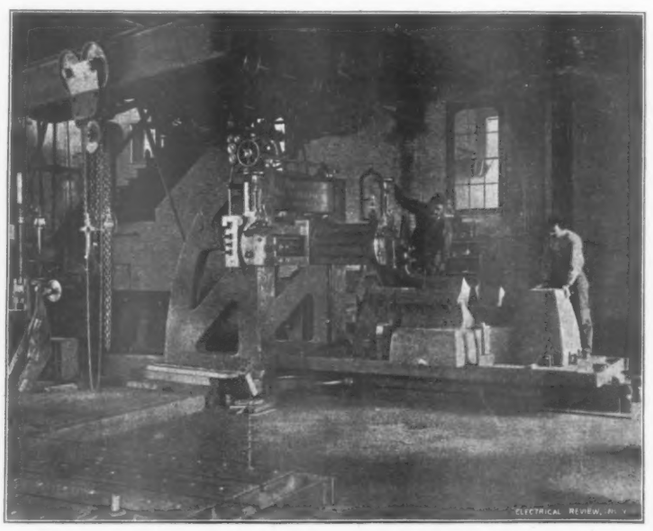


FIG. 5.—VIEW OF LARGE PLANER AT WORK ON EDDY GENERATORS FOR WORLD'S FAIR.

by fuel oil. A small engine is used for forcing the draught, and one of the company's motors is used in addition when testing the large generators. At such times nearly 300 horse-power is needed. Four 25 horse-power machines are used for lighting and power purposes, and two additional

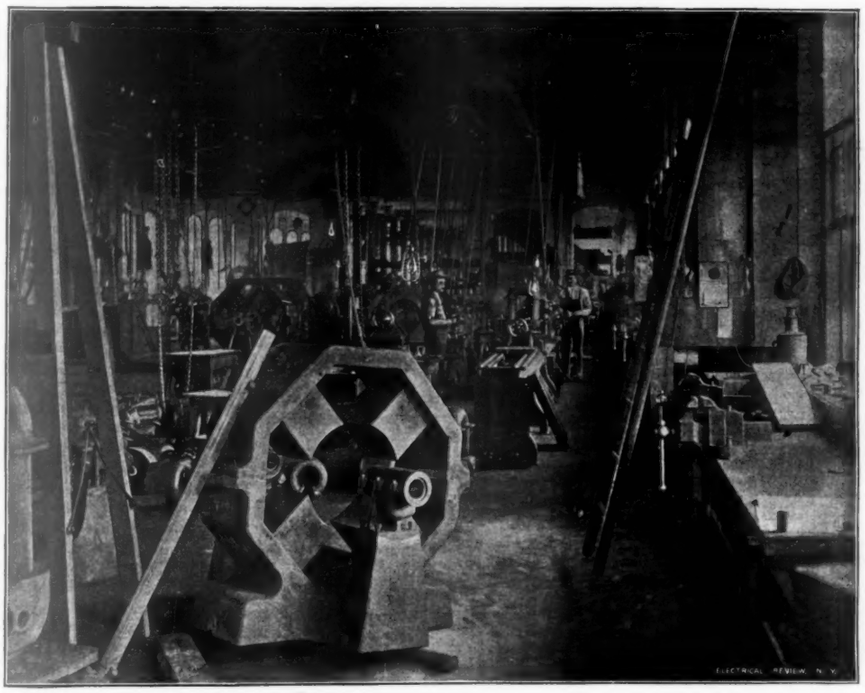


FIG. 6.—VIEW OF END OF MACHINE SHOP, SHOWING SKELETON OF LARGE GENERATOR FOR WORLD'S FAIR.

machines of 100 horse-power each are now being built.

The balance of the ground floor is occupied by the buffing and polishing room, the armature department and the shafting and commutator departments. Here are to be seen some valuable special tools, the principal of which is an automatic screw machine. This is used for making a number of articles, such as binding posts, studs and bolts. On the upper floor is the spool winding department, the soldering and insulating room, armature winding department, drying ovens and store rooms.

Here, also, is the instrument room, a very important feature, used for calibrating and recording resistances of the machines while being tested. Wires run from here tot he testing department, and a complete record of each machine while under full load is kept and filed for future reference.

The general offices occupy the ground floor at one end of the main building, covering a space 30x50 feet, and above them is the draughting room, the office of the electrical engineer, and the speed indicator department.

The pattern shop and blacksmith shop occupy two separate buildings, in the rear of the main structure, the former being 25x72 feet and three stories in height, and containing the necessary machinery for wood working of all descriptions.

The blacksmith shop is also of brick, 30x50 feet, and one story high.

The entire plant is heated by air forced over steam pipes and distributed to all parts of the building, and lighted by both arc and incandescent lights. There are 600 of the latter and a large number of Waterhouse arcs, run two in series, on incandescent circuits.

Two Morse elevators with automatic hatch devices furnish easy access to the different floors, and a railroad track runs the entire length of the shop, on which the heavy castings, some of which weigh six tons, are moved.

The factory stands within 50 feet of the main line of the N. Y., N. H. & H. R. R., and a siding runs directly to the door of the shipping department, so that their facilities in this respect are unsurpassed.

The various machines made by the Eddy Company are too well known to need any description, and their reputation for efficiency and general excellence of construction have brought them a large share of the popularity they so well deserve.

The officers, Mr. Newton being the active business manager, are as follows: A. H. Eddy, president; A. D. Newton, secretary and treasurer: M. E. Baird, general agent; Geo. T. Briggs, superintendent, and H. S. Rodgers, electrical engineer.

A. H. Eddy, president of the company, started his business career by taking a business course at the very successful Polytechnic School, at Troy, N. Y., after which he connected himself with the Corliss Engine Company, of Providence, R. I., in their heavy machinery department. He was in this department two years, then taking up the lighter class of work for the two years following. He then went to Hartford, Conn., connecting himself with the Weeds Manufacturing Company, now more familiarly known as the Pope Manufacturing Company, when the bicycle works first started. He then took up the work of the telephone, and later accepted an offer from Marshall Jewell, in 1879, as general manager of the Southern New England Telephone Company. In 1880 he was for a short time connected with R. H. Mather in bringing out a new plating machine, and soon after started out for himself in the manufacture of these machines, and built some 160, all of which are in use to-day.

M. E. Baird, the general agent of the company, started his business life as an office boy with Holmes, Booth & Haydens in Boston, being connected with this concern for three years. He then went to Philadelphia, where he was located for two years more in their Philadelphia office, after which he accepted a position with the same firm as general traveling agent direct from their headquarters at Waterbury, Conn., holding this position for five years, when he accepted an offer from the Eddy Electric Manufacturing Company as general agent for the company.

A. D. Newton, secretary and treasurer of the company, attended the public school at Hartford, Conn. After leaving school he became connected with a large wholesale dry-goods house in Hartford, where he stayed for three years. He then became associated with Mr. A. H. Eddy, who was engaged in the manufacture of machines for electroplating, and upon the organization of the Eddy Electric Manufacturing Company, he became its secretary and treasurer, a position which he has filled with great credit to himself. He is largely responsible for the prosperous and extensive growth of this well known company.

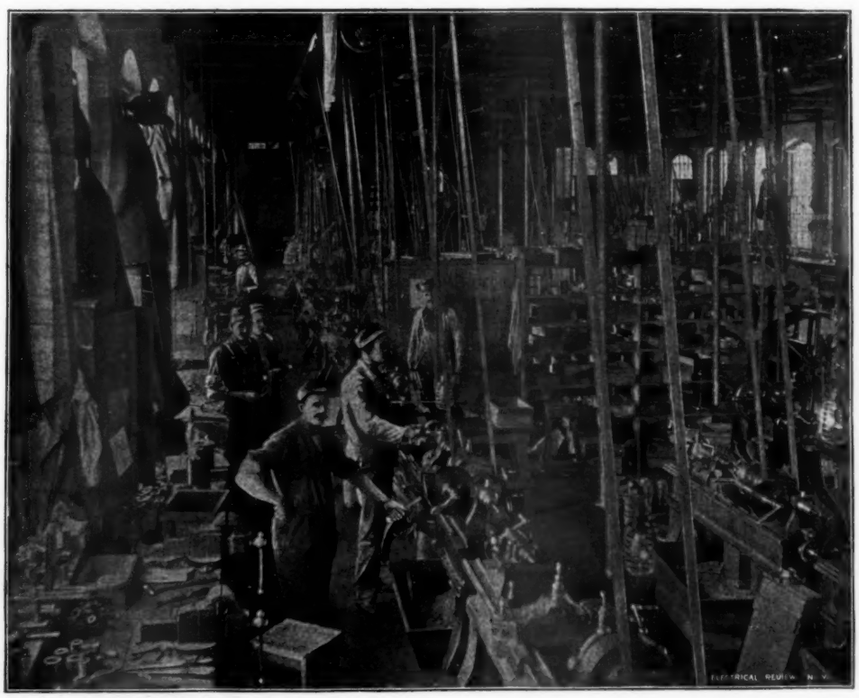


FIG. 7.—GENERAL VIEW OF MACHINE SHOP, EDDY COMPANY.

ELECTRIC LIGHT FLASHES.

The building of the Victoria *Times*, of Texas, is being wired for a complete electric installation.

The Piedmont pulp mills of Cumberland, Md., are having a new electric light plant erected by an Indiana firm.

Now that the Westinghouse lamp has been delivered to consumers, there will, undoubtedly, be some severe trials given it in order to determine whether the innovations will prove a thorough commercial success.

A fire occurred in the dynamo room of the Chicago Edison Company, and as a result that portion of the city supplied with light by that company was left in darkness for a while. Prompt work of the fire department prevented any serious damage.

The work of extending the plant of the People's Edison Power and Illuminating Company, at River Point, R. I., is being pushed as rapidly as possible, and as soon as the new 450 horse-power engine, which has arrived, is set up, the present system will be extended to a distance of 18 miles.

The plans for the power house of the Cataract Construction Company, at Niagara Falls, to be built at Lockport, N. Y., are now being drawn and it will be one of the strongest in construction that can possibly be built out of steel, brick and cement. The building will face Buffalo street, but its front wall will be inside of the Junction railroad tracks, and it will be constructed immediately over the big wheel pit.

The Middletown, Conn., Electric Light Company, and Messrs. Ward, Leonard & Company, of New York, have been sued by the Middlesex Mutual Assurance Company, for $40,000, the amount of damage caused by the burning of the Opera House, in Middletown, in June last. It is claimed that the defendants improperly wired the building for electric lights, and further alleged that the fire was caused by carelessness.

Manager Huebner, of the telephone exchange, of Burlington, Ia., gives the cheering intelligence to the residents of that city that all the material necessary for the McCluer return circuit, which is intended to overcome the induction of the electric light and motor line wires, is on the ground. A force of men will be on hand in a few days to begin the work of removing the "planing mills" from the patient subscriber's telephone.

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. Box 3329. NEW YORK.

EDITOR:
CHARLES W. PRICE.

ASSOCIATE EDITORS:
STEPHEN L. COLES.
ROBERT H. READ.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

"1546 CORTLANDT." TELEPHONE CALL.

BOSTON OFFICE:
H. G. TUCKERMAN, Room 29, 620 Atlantic Ave.

CHICAGO OFFICE:
MERWIN J. BULKLEY, 435 "The Rookery."

WASHINGTON OFFICE:
GEO. C. MAYNARD, 1409 New York Ave.

ADVERTISING DEPARTMENT,
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NEW YORK, MARCH 4, 1893.

CONTENTS.

	PAGE
Views, News and Interviews	29
The Electrical Special	29
The Electric Railway Mail Service at St. Louis.	29
A 6,000 Foot Span of Wire	30
A Telephone for An Audience	30
Detroit Talks to New York, Chicago and Pittsburgh	30
Light and Power Stations	30
New Queen Measuring Instruments of Precision	31
A Great Manufacturing Company	32
Electric Light Flashes	33
Dangerous Misinformation	34
Is the Steam Locomotive an Electric Generator?	34
Correspondence:	
Our Boston Letter	35
Our Chicago Letter	35
The Latest in the Edison-Westinghouse Litigation	35
A Kitten to Carry the Conductor	35
A One-Sided Way of Measuring Current	35
Letters from a Laboratory	35
Rules for Electric Light Work	36
The Power Plant at the World's Fair	37
Electric Signaling to Balloons	37
An Electrical Bonanza	38
A New Relay Patented by Messrs. Siemens & Halske	38
The Famous Bell Patent	38
Lodge & Shipley's 30-inch Motor Gear Lathe	39
The Action of Ozone on Bacteria	39
A New Press for Cutting Armature Discs	40
Electric Railway Combination in Philadelphia	40
400 Horse-Power Tandem Compound Ball Engine	40
Literary	40
A Large Municipality	40
Advance Information	41
The Detroit Dynamo Company's "King" Dynamo	41
Electric Railway Notes	41
Kindred Interests	42
An Excellent Way to Utilize the Refuse of Towns	42
Clamond's Microphone and the Berliner Transmitter	42
Electrical Patents	xii

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE.
American Electrical Works, insulated wire.	i
Anaconda Brass & Copper Co., wire	xxii
Armington & Sims, engines	xxii
Babcock & Wilcox Co., boilers	xxii
Beacon Vacuum Pump Co., inc. lamps	i
Bliss Co., E. W.	i
Brush Electric Co., apparatus	xxi
Campbell Electrical Supply Co., insulating tape	i
Crocker-Wheeler Motor Co., motors	i
Day's Kerite, insulated wire	i
Dwight Slate Machine Co.	xxii
Eastern Electric Cable Co., insulated wire	xxii
Eddy Electric Mfg. Co., motors	i
Faraday Carbon Co., carbons	xxii
Hampson & Co., E. P., engines	xxii
Jewell Belting Co., belts	xxii
Jones & Son, J., electrical supplies	xxii
Massachusetts Chemical Co., insullac	i
Mather Electrical Co., power generators	i
Moore, Alfred F., wire	xxii
Noye Mfg. Co., John T., engines	xxii
Okonite Co., insulated wire	i, ii & xxii
Otis Bros. & Co., elevators	xxii
Paine & Ladd, patent attorneys	i
Riker Electric Motor Co., motors, dynamos.	i
Simplex Electrical Co., insulated wire	i
Waterhouse, Gamble & Co., arc lamps	i
Westinghouse Electric & Mfg. Co., electrical apparatus	xxxi
Weston Engine Co., engines	i
Wilmot & Hobbs Mfg. Co., bell gongs	xxii

INSIDE PAGES.

Alexander, Barney & Chapin, sal ammoniac	iii
Allis & Co., Edward P., engines	xiv
American Bell Telephone Co.	viii
American Engine Co., engines	42
American Fluoride Co., fluoride	xiv
Arbuckle, F. P.	xv
Baker & Co., platinum	xii
Ball Engine Co., engines	ix & xii
Ball & Wood Co., engines	xi
Barrett, John A., electrical engineer	xii
Berlin Iron Bridge Co., iron roofs and buildings	xx
Bickford & Francis Belting Co., belts	xi
Billings & Spencer Co., commutator bars	42
Bishop Gutta Percha Co., insulated wire	x
Blaisdell & Co., tools	xiv
Boston Gear Works, gears	xi
Brill Co., J. G., tramway cars	viii
Brown Electric Co., electrical supplies	xv
Buckeye Engine Co., engines	xx
Butler Hard Rubber Co., hard rubber	xxii
Carpenter Enamel Rheostat Co., rheostats	xiv
Central Electric Co., supplies	xv
Chicago, Milwaukee & St. Paul Railway Co.	xvii
Church & Sleight, tools and supplies	xx
Clark Electric Co., arc lighting	viii
Consolidated Electric Manufacturing Co., dynamos	iii
Cowles Electric Smelting & Aluminum Co., aluminum	42
Cutter Electrical & Mfg. Co., reflector shade	xvii
Cutter, George, electrical supplies	x
Davidson Ventilating Fan Co.	xvii
Detroit Electrical Works, apparatus	x
Dewey Electric Heating Co., electric heaters	xv
Dixon Crucible Co., belt dressing	viii
Dunderdale, F. C.	xviii
Electric Construction and Supply Co., Ward arc lamps	iii
Electric Secret Service Co., cut-outs	xviii
Electrical and Mechanical Engineering and Trading Co., contractors	xiii
Electro-Light Engraving Co., engraving	xii
Elektron Mfg. Co., motors	x
Empire China Works, porcelain specialties	xviii
Falls Rivet & Machine Co., friction clutches.	v
Fort Wayne Electric Co., Wood arc lamps	v
Garvin Machine Co., tools	xiv
General Electric Co., inc. lamps	iv
General Incandescent Arc Light Co., arc lamps	iv
Gleason Manufacturing Co., E. P., electrical appliances	viii
Goodyear Hard Rubber Co., hard rubber	xii
Greeley & Co., The E. S., supplies	xv
Harrisburg Foundry & Machine Works, engines	xx
Holman Electrical Co.	xi
Holmes, Booth & Haydens, insulated wire	viii
Hotel Vernon	xvii
Hulbert Fence and Wire Co.	xiv
Johns Mfg. Co., H. W., vulcabeston	xviii
Jones & Son, J., electrical supplies	x
Lake Co., J. H. & D., pulleys	xviii
Leclanche Battery Co., batteries	xi
Lehigh Valley Creosoting Co., creosoted lumber	42
Leffel & Co., James, water wheels	xii
Marshall, Wm., condensers	xii
Massachusetts Chemical Co., insullac	vii
May Bros.	xii
Morrison, Geo. H., engine indicator	xiv
National Electric Mfg. Co., dynamo electric machinery	xx
National Pipe Bending Co., feed-water heater	xiv
New England Butt Co., braiding machinery.	xviii
New Jersey Lamp & Bronze Works, electric and gas fixtures	xi
New York Belting and Packing Co., rubber belts	xvii
New York Insulated Wire Co., wires and cables	xviii
Onondaga Dynamo Co., electrical apparatus	xi
Ostrander & Co., W. R., supplies	xviii
Palmer Bros., engine castings	42
Penn Life Co., insurance	42
Phœnix Glass Co., glass globes	viii
Phillips Insulated Wire Co., electric wire	vi
Phosphor Bronze Smelting Co., castings	xv
Queen & Co., electrical instruments	xii
Railway Equipment Co., elec. r'y supplies	viii
Reed & Co., F. E., lathes	xx
Rhode Island Tool Co., tools	xx
Ridlon & Co., Frank, general machinery	xx
Ries Electric Specialty Co., regulating socket	xviii
Robinson & Orr, steel rails	xv
Rosenbaum, Wm. A., patent attorney	xii
Royce & Marean, electrical supplies	xvii
Russell & Co., steam engines	xiv
Schuyler Electric Co., arc lighting	viii
Siemens & Halske Electric Co., electrical machinery	vi
Shawmut Fuse Wire Co., fuse wire	xiv
Shoemaker, Homer, attorney and counsellor-at-law	42
Standard Electric Co., arc lighting	xiii
Standard Paint Co., insulating compounds	xiv
Stanley Electric Mfg. Co., transformers	vii
Stevens & Morris, engravers	xv
Stocking, E. B., patent attorney	xii
Swan & Lane, contractors	xx
Tregoning, John, books	42
Tyndall, Wm. D., attorney	xii
Underwood Mfg. Co., cotton leather belting	xiii
Walworth Mfg. Co., trolley poles	iii
Washburn & Moen Mfg. Co., wire	x
Western Electric Co., supplies	xv
Western Electrical Supply Co., electrical supplies	vi
Westinghouse Electric & Mfg. Co., incandescent lamps	xix
Wilson, Fremont, electrician	xii

March 7 is getting pretty close to us now, and the fun in telephone circles will soon begin.

It is declared that the electric motors under street cars have been almost ruined by salt water dashed upon them during the winter's snow falls, after the salt car had been sent over the line.

Will the increased rates for messenger service and rental charged for call boxes prove a profitable system to the American District Telegraph Company? We are aware of several losses which the company will sustain, and are rather doubtful as regards the successful results of this advance in prices.

The recent annual banquet of the New York Press Club brought together as great a gathering of leading New York citizens as has been seen in this city for many a day. All the principal electrical papers are represented in the Press Club, and it is probable that these electrical journalists will get together to furnish something electrically novel for the great Press Club Fair, which is to be held in this city in May.

It is a well known fact that any metallic wire if brought near another wire carrying a current of electricity will have a current induced in it. In a crinoline there is a considerable amount of wire, and it naturally follows that if the wearer comes near an electric light circuit a charge will be induced around her and the hoop-skirt will become a living, seething mass of wriggling, sparking electricity, and no one dare imagine what might become of the poor unfortunate within. If she has the *sang froid* to come in the neighborhood of an electric light there is no telling the awful consequences that might arise. The reason why the ancient dames who donned the crinolines were not ruthlessly slaughtered by the thousands is because there was no electricity lying around loose in those days. Tell this to your wife; if she won't believe it invent some other yarn more terrible.

It appears that the State Electric Light and Power Company, of Brooklyn, have been vainly trying to get a franchise from the Aldermen. President Noah L. Cochen, of the company, has now offered $10,000 for the franchise, and also engages to furnish the city with lights at a 20 per cent. reduction on the present rates. He also says that he will guarantee to have the work completed and the plant in operation within 90 days. We are waiting for developments, and wonder whether this communication will be acted upon or whether it will be given a quiet resting-place in some out of the way pigeon-hole.

DANGEROUS MISINFORMATION.

The following, published last week by our neighbor, the *Electrical World*, promises to get those who heed the advice into a peck of trouble:

According to an interpretation of patent law that has been upheld on various occasions, avoided on others, and never actually and decisively passed upon by the Supreme Court, the life of a patent in the United States is limited by the life of the foreign patent that expires soonest. This affords comfort to many who desire to see an end of the fundamental telephone patents, all of which have expired in England and should, therefore, have expired here. The Bell receiver patent expired in England more than two years ago, but the fundamental method patent was still in force here (and will be until March 4), and that covered the receiver, preventing any one in this country who might have been so inclined from taking advantage of the expiration of the British patent on the receiver and entering on the manufacture of magnet telephones. Those who hold that the death of a foreign patent also kills off the American patent, and have the courage of their convictions, can make and use or sell both transmitters and receivers after March 4, as the British patent on the Blake transmitter also expired last month. It is very doubtful, however, whether this clause of the patent laws is good law, and will be upheld by the Supreme Court when it eventually has to be passed on, which must occur some day. Other phases of the patent part of the telephone situation will be taken up in the next article.

The writer who freely offers this gratuitous advice has wholly misapprehended the point at issue in the "interpretation of patent law" to which he refers. We quote the statute 4887, R. S.:

"No person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid by reason of its having been first patented or caused to be patented in a foreign country, unless the same has been introduced into public use in the United States for more than two years prior to the application. But every patent granted for an invention which has been *previously* patented in a foreign country, shall be so limited as to expire at the same time with the foreign patent; or, if there be more than one, at the same time with the one having the shortest term, and in no case shall it be in force more than 17 years."

Note the word *previously* ignored by our contemporary. On this hangs the law and the prophets. A patent in the United States is "limited by the life of the foreign patent that expires soonest," only when that foreign patent was issued before the United States patent. No court has ever been in doubt about this. The matter of doubt has only arisen in cases where there was a prior foreign patent, and affected the subject only because there was a difference of opinion as to the length of term of some foreign patents.

IS THE STEAM LOCOMOTIVE AN ELECTRIC GENERATOR?

A curious trouble was recently reported to us by a Pennsylvania telegraph man. It seems that at a particular time each day the telegraph instruments at a certain railroad station indulged in curious freaks, emitting long sparks, shocking the operator and behaving in every respect as though there were a heavy lightning storm somewhere upon the line. The persistent regularity with which this trouble occurred, even on the clearest days, with no traces of atmospheric currents to be found, together with a careful but fruitless investigation for all known possible causes, served to deepen the mystery. It seemed to be one of those "spook" troubles which form the basis of many of those stories which make part of the stock in trade of every old-time telegrapher.

Things went on in this fashion until one day the operator noticed that the sparks from the instrument seemed to keep time with the blasts of steam from a locomotive which was standing immediately below the troubled wire. Following up this clue, it was found that the spark could be produced at will by blowing off steam from the locomotive under the wires. It so happened that it was necessary for the locomotive to stop each day at this point to take water. So the position of the wire was changed and the trouble never reappeared.

It seems such an extraordinary kind of a telegraph fault, that our Pennsylvania friend has much difficulty in having his story accepted among the fraternity.

Another case that came to our notice, where a line was troubled in a similar way, and the lineman sent out to investigate the difficulty got a series of shocks, which corresponded in time to the puffs of a locomotive a short distance away from him directly under his wires. The steam locomotive not being usually regarded as an electrical apparatus, it seemed extraordinary that it could produce an electrical disturbance on neighboring wires.

We are inclined to believe, however, that both of these stories are correct and that the locomotive is the direct cause of the trouble, in fact it forms a beautiful example of the hydro-electric machine of Lord Armstrong. This is a machine which consists of an iron boiler, containing a fire and mounted on insulated legs. Steam under pressure is generated and allowed to escape through a number of nozzles, in such a manner that the particles of water carried with it are charged with frictional electricity, and collected upon a suitable surface held in proximity to the jets.

By this means very long sparks have been produced and it is capable of giving a very severe shock, in fact its discovery was due to the accidental shock which a workman received who happened to hold one hand in a jet of steam escaping from a boiler and the other hand upon a safety valve, thus forming a circuit of his body, through which the current flowed.

It is not altogether clear that the phenomenon we have been describing might not in some cases be a dangerous one to certain electrical apparatus. Take the case of a trolley wire under which a locomotive is blowing off steam. Under these circumstances a dangerous spark might be produced in the armature of the central station generator which might result in a short circuit. There are, we believe, no records of such accidents, but wherever a trolley wire is likely to come under such influence we think it is well worthy of investigation.

The Société Général Des Téléphones, of Paris, have issued a profusely illustrated catalogue of their telegraphic apparatus which may be obtained from them at their address, 41 rue Caumartin, Paris, France.

The Direct United States Cable Company, of New York, Limited, have sent to their favored friends handsome paper cutters on which are printed a well-drawn map and a calendar.

CORRESPONDENCE.

OUR BOSTON LETTER.

Owing to the increasing business and the pressing need of better facilities The F. E. Belden Mica Mining Company have removed their offices from 28 School street, where they have been for a number of years, to 12 Broad street, and are now occupying a good sized store at the latter address.

The Quincy & Boston Street Railway Company have purchased the controlling interest in the Manet Street Railway Company, a line four miles in length connecting Quincy Centre with Hough's Neck and Manet Beach, the summer resort. The road has been earning about 5 per cent., which has been used up in construction.

The Board of Selectmen, of Stoneham, Mass., have their hands full at present, as three rival railway corporations are striving for a right of way through the town. The companies mentioned are the Wakefield & Stoneham Company, The Boston, Malden and Stoneham Company, and The Mystic Valley Company, which has been recently organized. The locations asked for all conflict at one point at least, and the fight promises to be a lively one. A hearing on two of the petitions was give last week, and a second one will be held in the town hall on March 11.

The Beacon Vacuum Pump and Electric Company, though temporarily downed in their recent encounter with the General Electric Company, express themselves as still full of fight and very confident of an ultimate victory. Their next step will be an appeal for a stay on the injunction granted by Judge Colt, and if this is allowed, granting them the privilege of continuing the manufacture of their lamps pending the further trial of the case, it will be carried at once to the United States Circuit Court of Appeals. If not, and they are compelled to remain shut down, they say they will be on the market within 60 days with an entirely new lamp, one that will not only *not* infringe on the Edison patent, but will be patented by them as another invention altogether. Such a lamp would make things exceedingly lively in the trade, and is undoubtedly something which has long been looked for. Whether the Beacon Company can fill the bill remains to be seen. They themselves express unbounded confidence in their ability to do it, and say the fight, far from being finished, has just begun.

A Very Successful Test of a new system of electric heating for street cars was made recently on one of the cars of the West End Road. Car 626 of the Milton line was the one selected, and the trip was made with a degree of comfort to the occupants which has heretofore been an unknown quantity to the patrons of the West End system. A more unpleasant place in which to spend even a limited time than a Boston street car it would be hard to find, especially in the kind of weather which has prevailed this winter, and those who were fortunate enough to make the trip without the usual accompaniment of physical suffering were only too anxious to have the system adopted. The method used in this instance is at once simple and effective, and consists of heating a liquid chemical compound by means of electricity and forcing it through circulating pipes which distribute to all parts of the car. The degree of heat can be easily regulated while the car is in motion, and after the pipes have once been thoroughly heated they retain a large percentage of it for a considerable time after the current has been turned off. The invention is known as the O'Neill electro-thermal system, and Mr. H. G. O'Neill is the inventor.

Now That the Decision in the Edison-Beacon lamp suit has been rendered and the mooted question settled, temporarily at least, it is well to stop for a moment and consider the possible results, not so far as any individual company is concerned, but on the status of the trade in general. The country is full of alarmists ready to prophecy all sorts of evils, and depict any number of disasters to follow in the path of the all-powerful victor of so many legal battles. As a matter of fact, is anything of the kind liable to happen? Such a condition of affairs would be more disastrous to the General Electric Company than to any one else, as they certainly have the most capital invested. Is it not logical to presume that the men who have built up and fostered the industry from the beginning, who have watched its development and stood ready to stake their last dollar on its success, will be the last ones to administer a fatal blow? The brains which have been capable of planning and the hands which have carried out all that has so far been accomplished in this remarkable history of advancement are still at the helm, and are not likely to run the ship they have built, launched and sailed successfully for years deliberately on the rocks of bankruptcy. Rather let us believe that more care than ever before will be exercised in the future, and the business placed on a sounder and more profitable basis.

The "Commercial Bulletin," of Boston, comes out in its issue of February 18 with a rabid article on the "Bell Telephone Monopoly," in which it cites the "fraud and outrage" which has been perpetrated, not only upon the United States government, but upon the public at large, and dilates upon the woes of the business man and the "outrageous tribute" which he is compelled to pay to this "most grasping of monopolies." Before flying off in this philanthropic vein, would it not be well for our esteemed contemporary to reflect for a moment on the immense advantages enjoyed by this same business man through the development of the telephone system, and also that its use is not made compulsory. That if he puts in a telephone he does it with his eyes open, knowing just what it will cost him beforehand, and presumably under the impression that his increased facilities for transacting business will compensate him for the outlay. No doubt it would be very acceptable to most people to get things that have become a necessity to them at half the price they have been paying for them, but even then there are some who would consider another 50 per cent. reduction as quite the proper thing, and kick because they did not get it. In view of what the telephone companies have done in recent years, in the way of improvement and extensions of their service, and notably the event which was celebrated in Boston and Chicago this month, our philanthropic friends should consider that it takes money to conduct enterprises of this kind, and that those who advance it for such purposes expect to make it pay a fair rate of interest on the investment, as well as prove a benefit to the public at large. While the tariff cannot be made that would suit the depth of every individual pocketbook, the majority seem to be able to take advantage of a good thing when they find it, and are willing to pay for it, and those who do not feel so disposed have always the privilege of letting it alone. H. G. T.

Boston, February 25.

OUR CHICAGO LETTER.

W. R. Mason, general manager of the Railway Equipment Company, left Tuesday, this week, for a ten days' trip throughout the East.

W. J. Clark, acting general manager of the railway department of the General Electric Company spent the past week in Chicago. Mr. Clark left for New York Thursday night.

George Cutter has brought suit against the Carpenter Electric Heating Manufacturing Company, St. Paul, Minn. One suit is brought to set aside their patent and another for infringement with an accounting.

A. H. Lynch, of Waterhouse, Gamble & Company, was in the city Wednesday of this week. Mr. Lynch is making a tour of the Western States and reports that the Waterhouse lamps are meeting with approval wherever they are being used.

Mr. E. W. Little, general manager of the Interior Conduit and Insulation Company, New York, accompanied by Mrs. Little, are registered at the Auditorium. Mr. Little expects to spend ten days in the West and will probably attend the St. Louis Convention.

J. A. Hanna, of the McGuire Manufacturing Company, has just secured an order for 75 Columbian motor trucks from the Rochester City Railway, Rochester, N. Y. This truck is the latest improved motor truck built by this well known company, and has given universal satisfaction wherever used. The McGuire Manufacturing Company has opened a Canadian factory at St. Catherines, Can., thereby giving the Canadian roads the benefit of the saving on duty, which amounts to 35 per cent.

Eight Hours and three dollars per day is the demand made by the men employed on electrical construction work at the World's Fair Grounds. A deputation representing the National Brotherhood of Electrical Workers declared that unless their demands were granted the men would stop work, which they did Thursday of this week, as their demand was refused.

Leaders in the movement say that men employed in similar work in the city are paid from $2.75 to $3 a day, and that all the men who quit work at the Fair can get situations in town at those rates. They say, too, that the National Brotherhood of Electrical Workers, to which the dissatisfied men belong, is affiliated with the Building Trades Council, and that all the members of the latter body may eventually be drawn into the strike.

It is claimed that when the men were first employed Director of Works Burnham agreed that they should work but eight hours a day. This agreement, it is said, has been violated, the hours having been uniformly nine hours a day. The men, who say they are employed by the World's Fair Commission and the New York Insulated Wire Company, called on Mr. Burnham Monday and demanded eight hours work and $3 per day, the prevailing rate of wages being $2.50 a day. M. J. B.

Chicago, February 25.

The Latest in the Edison-Westinghouse Litigation.

Judge Acheson, of Pittsburgh, read an opinion, on February 23, in the case of the Edison Company against the Westinghouse Electric and Manufacturing Company. The latter company entered proceedings for the purpose of determining the right to manufacture their all-glass stopper lamp.

The decision was to the effect that the question was not one to be determined on a motion for a preliminary injunction on *ex parte* affidavits at the request of the defendants, but that the difference in the construction of the lamp is such that a decision should only follow a final hearing after the taking of testimony in the usual manner and after trial.

It is declared in Boston that the Westinghouse people say that now nothing can be done against the new Westinghouse lamp until the case has been tried, which will take at least two or three years, during which time the Edison patents will have expired.

Following is Judge Acheson's decision:

While we are quite prepared to accept the defendants course in taking this rule as evidence of good faith to the court and as indicating a purpose to avoid even the appearance of a wilful disobedience to our writ of injunction, yet, under the circumstances, we think it would be going too far at their instance and in this summary way to enter upon the consideration of the question whether the lamp now submitted infringes the patent in suit. This lamp was not before the courts of the second circuit of New York, and the question of infringement involved in this rule is entirely new. There is a marked difference of structure between this stopper lamp and the lamps enjoined, but enough appears to satisfy us that the question of infringement cannot be determined safely upon a mere inspection of the lamp. No investigation would be complete without the aid of expert testimony and evidence touching the art of electric lighting in its earlier stages. But *ex parte* affidavits upon these subjects (and this rule contemplates nothing more) would be most unsatisfactory. Moreover, should the rule go to hearing on the merits, the action of the court thereon would be inconclusive.

The rule to show cause, granted February 1, 1893, will, therefore, be discharged, but without prejudice to the defendant's rights to set up in their answer the matters upon which said rule was founded. And it is so ordered.

A Kitten to Carry the Conductor.

The domestic cat has often been quoted as one of the readiest sources whence frictional electricity may be derived, but in its latest connection with electricity it plays an entirely new part. A building in a Massachusetts town had been wired for electric lights, and it was found necessary to pass an electric wire from one side of a room to the other under the floor. This was likely to entail a serious loss of time and labor in excavating, but an ingenious ruse got rid of the difficulty. One of the men hit upon the plan of making a hole at each end of the room. Then taking a long piece of fine twine he tied it around the body of a live kitten, which was placed through one of the holes into the space under the floor. By a little coaxing the cat soon found her way to the hole at the other end of the room, where the light was shining in. Thus the fine twine was passed through, and was attached to a stronger piece, which was in its turn drawn through, and made the means of drawing the wire right through the opening.

A One-Sided Way of Measuring Current.

A somewhat original scheme for recording the supply of current to the customers of central stations has been proposed by Prof. Garnett. The method is based on the Scott meter system. It is proposed to devise an automatic control over the central or governing clockwork which would make the duration of the registering gusts of current dependent upon the station output at the time. Thus more or less would be charged at different times, according to the load on the station. It is clear that a meter subjected to this system could not be expected to register board of trade units, nor would it afford any fair indication of the energy actually consumed, as any consumer, by turning on several lights at once, could alter the price considerably for all his neighbors on the same circuit.

The Railroad Commttee in the Municipal Assembly in St. Louis, Mo., have recommended that the Jefferson Avenue Railway Company be permitted to change the motive power of their road to electricity.

LETTERS FROM A LABORATORY.—XXXIV.

BY JULIAN A. MOSES.

Where an electric light is available in the laboratory, incandescent lamps may be used to illuminate dark nooks, corners and closets. Incandescent lamps are for this purpose far superior to matches, candles or even kerosene lamps or gas. Fire insurance companies books will show that many conflagrations in laboratories have been due to careless handling of matches, etc., in searching for things in out of the way places. The occasional use that is made of the incandescent lamp for this purpose makes the cost of them inconsiderable, and this element should not enter into any consideration of an argument against their use. The original installation is the only expense, and need not be much more than double the cost of a lamp for each light. The switches should be placed outside the closets so as to be readily accessible. By this means of illumination small and inconveniently dark places may be safely and well lighted.

If the place to be illuminated is damp, it is best to have the incandescent lamp provided with a moisture-proof socket, which generally may be purchased at any electrical supply store. If such a socket is not wanted, the connections and leading-in wires may be soaked in melted paraffine. Lamps and connections prepared in this way may be used in gas closets or any place where corrosive vapors might attack and destroy unprotected silk, cotton or metal.

The shelves in these and all closets should be thoroughly varnished, so that all dust or dirt may be brushed or washed off more easily. Those shelves which are allotted to hold glass tubes or any cylindrical articles, should be provided with a ledge projecting above the level of the shelf about a quarter of an inch, so as to prevent them from rolling off and being lost or broken.

Time and trouble may be saved by placing on the edge of each shelf a label showing briefly what may be the contents of that particular shelf. These labels are best made as follows: Cut strips of medium thick bristol board or ordinary stiff writing paper about three-quarters of an inch wide. These should be slipped into a piece of brass or tin about one inch in width, which must be bent over on the edges so as to allow the paper to slide through easily. The holder, if made of tin, may be cut out with a pair of stout shears; if made of brass they may be cut in a more ingenious way by employing the following means: Prepare a saturated solution of bichloride of mercury. Lay out whatever lines are desired on the piece of sheet brass by marking with the point of a penknife, using a ruler as a guide. Wash the brass thoroughly with a concentrated solution of caustic soda, or rub it with a stiff brush dipped in sodium bicarbonate in order to remove all traces of grease or oil. Dry the brass by gently heating it, and with a quill pen or a piece of sharpened wood dipped in the mercury solution, carefully trace the lines already scratched. Permit this solution to remain on the brass for a minute or two, and then with another pen or similarly sharpened piece of wood dipped in some moderately strong nitric acid, go over the lines marked with the mercury solution. A decomposition takes place and free mercury is precipitated, which immediately amalgamates with the brass and makes it exceedingly brittle at that place. By bending the brass backwards and forwards once or twice it will separate at the line marked. Larger and thicker pieces of brass may be thus cut, but in order to break them apart recourse must be had to a blow or two with a tool handle or a piece of heavy material that will not dent or mar the surface of the brass.

Unexpected accidents have happened, caused by the presence of a knot hole in a shelf. Two expensive thermometers having been broken in this way due to a piece of iron falling through such a hole has taught me that it is best to have all imperfections in the boards used for shelves stopped up. The best material for this purpose is plaster of Paris. The knot hole should be prepared to receive the thickly mixed plaster by boring with the point of a pen knife or a nail, several conical holes in the sides. These serve to hold the plaster in position which, just as it is setting, should be scraped off smooth and level with the top and bottom surfaces of the board.

Rules for Electric Light Work.

FULL TEXT OF RULES ADOPTED AT ST. LOUIS.

General Manager Ayer, of the Municipal Electric Lighting & Power Company, St. Louis, is very careful of the safety and welfare of his employés and has devised a book of excellent rules for their guidance and instruction. Every employé is required to carry a book of rules in his pocket and when the book is given to him he signs and returns to the company the following printed form :

INSTRUCTIONS AND CAUTIONS.

1. Do not handle any electric light apparatus while you are standing on the ground.

2. Never use both of your hands while handling dynamos, or anything pertaining to same, while said dynamos are being used.

3. Do not touch a water pipe, iron post, or any stone, brick or iron structure while in contact with a lamp, line, dynamo or anything connected with the electric light apparatus at the same time, unless you are provided with rubber gloves and other insulating material, which the Municipal Electric Lighting and Power Company has declared to you to be necessary and sufficient to fully protect you from accident by the electric current.

4. When your business necessitates your going through the station, keep as far as possible from the machinery and belting, and do not meddle with anything unless you are ordered by the man in charge, and then only after receiving careful instructions.

5. No one is permitted to in any manner work on the switchboards, except when directed so to do by the man in charge of dynamo room, and then only after receiving careful instructions.

6. Keep away from the lightning arresters and wires leading to them.

7. Linemen or others operating on lines *must handle each and every wire* at all times as if it were charged with the electric lighting current and grounded.

8. When obliged to pass over, under or by an electric wire, avoid touching it in any manner, and especially with any uncovered portion of your person. Damp or wet clothing makes chance contact with wire dangerous.

9. Tools used by linemen and others who have occasion to work on lamps or apparatus which may be charged with the current must have handles well covered with rubber or other insulating material, and it shall be the duty of every lineman to look after his tools and see that they are in good condition for use, and especially as to the insulation of the handles.

10. If it is at any time necessary to stand on the ground or any surface not insulated from the ground while handling electric wires or apparatus, heavy gum boots or an insulated stool must be used ; and under no circumstances allow yourself to make contact between two or more wires at the same time.

11. Lamp trimmers and others engaged in taking care of and trimming lamps must see that the switch on the board from which the lamp hangs is closed before they proceed to handle the lamp. Instructions laid down in article 3 of these rules must be observed in connection with the work of handling the lamps.

12. In the event of any one in any manner being caught on live wires, where it is possible to get to them, pull the one caught away by grasping any portion of his clothing or body protected by clothing. There would be no possible danger to the one rendering help, no matter where you may be standing. If the one caught should be on a pole or ladder, he could usually release himself by kicking himself loose from the supports, or drawing up his knees, thereby causing the body to fall. It is understood that employés will wear and use their safety belts when working above ground on poles or ladders, especially when handling wires.

13. Rubber gloves, rubber insulating material for tools used by employés, and other protective articles, will be found in the store-room. Employés have every access to these goods at all times through the storekeeper. They should examine their gloves and the insulation of their tool handles daily, and, if they discover any defects therein, return the same to the storekeeper, and select themselves perfect tools in place thereof. No charge has been made or will be made for goods thus exchanged. Employés who have been provided with tools must return them on leaving the service of the company, or the cost of the tools will be charged against their account.

14. Any employé known to violate any of the above rules, or disobey any of the instructions or cautions, thus endangering his own life or the personal safety of others, will be immediately dismissed the service, if complaint is made at the office.

I hereby certify that I have received and am in possession of a copy of the above and foregoing instructions and cautions relative to risks ; also a copy of the general instructions to employés of the Municipal Electric Lighting and Power Company, and that I am fully acquainted with the contents thereof, and that I have accepted employment from the Municipal Electric Lighting and Power Company as a..... ..... knowing fully the risks incident to my said employment and the business carried on by said company.

.....

ST. LOUIS, MO.,.....189....

Witness.....

The book of rules is as follows :

GENERAL INSTRUCTIONS.

1. All employés are requested to report anything of interest to the company which they may learn, whether in their department or not, so that the best results may be obtained at all times in all departments.

2. All instructions which follow must be read and observed by all employés, wherever they may apply to any work they are required to do, whether designated for the government of the department they are in or not.

3. At the station, papers and books are supplied relating to the business, and you are urged to spend an hour or two using them when you can.

4. All necessary line tools that you are required to have will be furnished by the company on application to the storekeeper, except pliers, connectors, climbers, screw-drivers, belts and other similar small tools. These tools all linemen must own. If desired, they can be purchased of the company, and on leaving they can be returned and the money will be refunded. All tools above mentioned issued by the storekeeper will be charged and deducted from your pay.

5. Do not use defective tools or appliances, whether yours or those of the company. If you have defective tools, ladders or other appliances, you are hereby ordered not to work with them, and no foreman or others must be regarded who instructs you otherwise.

6. A written report of all accidents, whether to persons or property, wherein this company could possibly be interested, must be made on the accident blanks and forwarded to the office as soon as possible after the accident occurs.

LINE WORK.

When cutting wire, grip the line with the cutting jaws of the pliers and move up and down at right angles with the wire two or three times, so that you cut the insulation part of the way round on both sides ; then hold your pliers firmly, bend the wire once or twice up and down with your left hand and the wire will break. Never try to break the wire by twisting your pliers, unless you first move the line out of the cutting jaws. There is no excuse for nicks in the cutting jaws of Stub's pliers, and careful linemen rarely have it happen.

7. In stripping the ends of wire to make a connection, always cut along the wire toward the end, in much the same manner as if whittling a stick. Never cut round the wire with the edge of the knife or pliers, except when cutting the wire.

8. In making joints, be careful never to let the cutting jaws or edge of your tools "score" the wire. If you do, don't cover it up, but make a new joint.

9. After a joint is made with not less than four turns each side of the connectors, dip or moisten with acid. If you are on the ground, dip the joint in melted solder and hold it there a few seconds to thoroughly heat the joint, then take it out. If well "tinned," dip it in water to remove any acid which may be on the ends of the wire under the insulation.

10. If where you cannot dip the joint, but have to use the ladle, pour the solder frequently over the joint, until it leaves a thin, smooth coating on the wire. It is not properly done if the solder is in lumps or on in a thick layer.

11. If you are obliged use a "blow pot," hold the joint in the flame until the solder will easily melt when held against the wire after the flame is removed. When this is accomplished, apply the solder with the flame, and not before.

12. Solder is put on the joints to keep them from corroding, thereby insuring good contact where the two wires come together, and is of no use if not well applied.

13. After the joint is well cleaned of acid after being soldered, paint it thoroughly with insulating compound, then cover with a layer of tape, which you will start on one side of the joint against the insulation of the wire, but not over it. Have the first layer cover the joint and bare wire only. When this is done, paint it, then start back over the joint and tape until you have run over the line insulation about two inches, then wrap two more layers, painting each when done.

14. In wrapping tape, cover what you have half, or lap one-half. After four layers are on, paint the whole thoroughly.

15. Whenever you find a break in the insulation on the line anywhere, paint it first, then tape and paint it. Don't forget this.

16. In "tying in," never draw the tie wire so as to bend a kink in the line or cut through the insulation with the tie. A tie will properly hold the wire in place without drawing it so tight as to do either.

17. In using pulley blocks on the line, avoid the use of "come-alongs" when possible, by taking a series of half hitches, or making a "noose wrap" with a small line on the wire to hook the block to. If you do use "come-alongs," see that you do not score, cut or kink the wire, and always paint and tape broken insulation.

18. Ground men are especially cautioned to watch the line in "paying out" and prevent "kinking." Should a short kink get pulled into the line, cut it out rather than take the risk of its breaking, though you should straighten it out.

19. Never use porcelain knobs where exposed to moisture or the weather, and never use them anywhere else if glass can possibly be used.

20. Porcelain knobs circuit breaks may be used where necessary, providing not more than two lamps are on the loop. In making them, paint and insulate with tape the joints in connecting wire of loop.

21. In making house connections where wires enter building, be sure to have not less than six inches clearance from cornices of walls. All wiring running over cornices or other building projections must be protected with rubber tubing, thoroughly taped and painted at the end. Never let a wire, however well protected, come in contact with any outside portion of the building.

22. In placing tubing on wire carefully paint and tape at the upper end, leaving the lower end open, so that moisture could escape if it got in.

23. Always run wires in straight parallel lines, and make square turns where possible. Twelve inches between wires is the proper space for arc lighting circuits, where practicable.

24. Never fasten a cut-out box against the wall. Always place glass or porcelain knobs between the box and the wall.

25. Never fail to put in "drip loops" in line where entering building.

26. In all electrical work, remember where insulation is desired it can never be too good, or when contact is desired, you can never make it too good or strong.

27. In removing lamps ordered out, always close the loop at the line where it was originally cut in, and remove all dead wire. Never leave dead or unnecessary wire in circuit.

28. Always use iron pins on arms where wires turn a corner or leave the line.

29. Never screw an insulator on iron pin or bracket very tight, nor without first putting inside the glass a strip of paper folded twice or three times. This will prevent the glass being broken, as iron expands with heat nearly twice as rapidly as glass, and unless there is room enough, the difference in temperature between winter and summer would burst insulators in summer which were placed in winter.

30. In connecting line to lamps hung from suspension wire, put on safety loops by making a half-connection with a short flexible wire on each side of the insulators at the pole and on the lamp hood. Solder and tape same as other joints. Arrange the length of wires leading to lamp so the lamp will not shadow the roadway of either street.

31. No joints are permitted to be made and left without being soldered.

32. When working on an arc circuit, always keep it closed, unless you are able to have it tested O. K. during the day from the station at 1 o'clock, and from 3 to 4, or as agreed with the chief inspector.

33. When placing guard wires on street crossings, always use iron pins and glass insulators to attach both ends of guard wires to. Never tie on cross arm on pole. In stormy weather, when they may be of use, they would be dangerous every way.

34. In working on lines, all circuits must at all times be regarded as alive and grounded. With the hundreds of miles of wire throughout the city, some of which are carrying heavy current at all times, many using ground return, the line you are on may "come alive" at any time—be careful.

35. Always avoid temporary work. If in your orders at all times to do what you do thoroughly.

36. When working on poles, be careful to stand so, if you should slip or get a shock, you would fall on your belt rather than on the wires.

37. Avoid leaning over or crowding through wires when possible, and do not put yourself in a position where you would fall on wires should an accident occur.

38. Always, in making connection on poles, work from below rather than above, when possible.

39. Examine cross-arms and see that they are sound and firmly fastened before trusting your weight on them.

40. Always report anything found defective, especially cross-arms or poles.

41. Be careful that all tools are securely fastened in your belt when working on pole or ladder, and in handling wires and lines on poles have a proper regard for the safety of those walking or driving below.

42. When working on poles, always use a safety belt, as well as other safety devices which you are requested to use. It takes but a little time to make yourself safe, and many weeks to mend a broken bone.

43. Never lay tools down when above the ground.

44. The company demand that you take the necessary time and precaution for your own protection and that of others at all times.

TRANSFORMER WORK.

45. In placing transformers and making connection for same, you will always leave the line connection where you branched off to be made after all other work is completed. The primary fuses at the transformer must be left out until the final line connection is complete. (For size of transformer fuse see page 10.)

46. In making connections to constant potential (alternating or 500 volt) circuits, always finish one connection before breaking the insulation on the other line. Remember this : That you must have but one wire or joint bare at the same time when working on lines.

47. After completing a transformer connection, and before closing line connection, carefully paint the entire outfit (except glass insulators) with insulating paint.

48. See that all wires leading out of transformers and out of fuse boxes are well taped and painted where they leave transformers ; and all transformers must be placed so far from doors, balconies, windows and other openings, and sufficiently high above ground and roof, as to prevent accidental contact ; in other words, out of reach.

49. All secondary wires from transformer to house should be as well insulated and protected from ground as if carrying high pressure currents.

50. In plugging brick or stone buildings, paint the plugs with insulating compound before driving them.

51. All supports for transformers and fuse boxes placed on buildings must be well painted with insulating paint.

INSPECTOR'S SPECIAL INSTRUCTIONS.

1. At all times when on duty your carts must be supplied with rubber gloves, boots, coat and hat ; also, pliers, connectors, climbers, jack straps and vise, safety belt, hand-ax, insulated stool, magneto, two or three brackets, and glass, tape, carbons, line wire, jumpers and hand line.

2. Inspectors away from their carts, or those not provided with carts, are requested to have and to use their necessary safety devices and clothing where handling lamps or lines.

3. In working on lamps or lines, always regard the line as grounded and alive, whether it is or not. Observe this rule in hunting trouble on "dead" circuits. They may be "O. K.'d" any time by others and the current put on without a report from you. They may also cross up elsewhere with live circuits.

4. Report to their headquarters, as soon as you can, any trouble discovered on the lines of other companies, and report dangerous conditions existing to the city lighting department, if you are in doubt as to the ownership.

5. Avoid interference with foreign wires where possible, but if you find the lines of other companies so situated as to be dangerous to the public, do what you think is right, and report to the owners and to this company by nearest telephone, and make written report as well.

6. In the event of injury to persons or property by the wires or appliances of this or any other company, where the electric current could possibly be the cause, investigate fully and make full written report to this company only. If trouble was the result of cross or dead or broken wires, find out how the cross was made, how the wire was broken, to whom the wires belong, the names of witnesses and parties damaged in any way ; in fact, report all you can find out and find out all you can.

7. Report by telephone, day or night, to the general manager any serious or unusual trouble as soon as practicable.

8. All repair work where material is used must be reported on a separate slip.

9. In putting on jumpers, be careful that the loop of jumper does not lie on wire below, to make a cross possible if the insulation does not hold.

10. All inspectors when away from the plant are requested to report by telephone as often as practicable. All inspectors must report as often as once an hour during their entire watch, especially if on trouble.

11. Inspectors must report by telephone to plant any repair work to be done by linemen which has been occasioned by temporary work while on watch.

12. Mounted commercial inspectors must remain at the office when not out with their horses on regular duty.

13. All mounted inspectors must keep their carts as near their work as possible when out ; at other times, at the station or office, and remain there themselves.

14. In addition to reporting by telephone when out, report to station at the time you go off duty, notifying the one in charge that you are off, and that you will be off after that time.

15. Record on telephone sheet any call for extra service, and report same to office on properly signed blank form No. 3.

16. No extra service will be furnished, except by instructions from chief of dynamo department or the office.

17. In clearing trouble of any kind, where temporary work only can be done by you, make a full report on separate trouble slip, so that it can be properly repaired later. Unsoldered joints, broken insulation, bracket work on poles or similar troubles, as well as defective pins, cross-arms, poles, windlass boxes, etc., should be reported separately.

18. Maps of alternating circuits, showing locations of branch cut-outs, must be carried by all inspectors.

19. Inspectors can find separate maps at station or office, which they can take with them if necessary.

20. All items of interest relating to the condition or operation of the plant in any manner you are requested to report.

21. Always be gentlemanly to customers and to the public.

22. Always wear your uniform and badges when on duty.

23. Always leave memorandum at station where you are gone.

INCANDESCENT WORK.

24. You must at all times be supplied with a complete supply of fuses. Exchange your wallet once a week, or oftener, if necessary, for a full one.

25. In renewing fuses be sure that the binding post screws which hold the line wires are firmly set. Fuses are frequently blown by loose line connections.

26. When primary fuses are blown, examine transformers for short circuit or leakage before replacing them.

27. When main line secondary fuses have blown, test with the current for ground, if circuit is being used, if not, test with magneto bells, first removing both fuses on main block and testing wires to lamps only.

28. In fusing primary circuits only, observe the following : Never fuse transformer with larger fuses than given below.

10 light,	½	ampere.	
20 "	1	"	
25 "	1	"	
40 "	2	"	
50 "	3	"	
100 "	5	"	

Never fuse transformers until all the work is completed on the outside lines and you know the inside work is ready.

29. For fusing on secondary circuits only, be governed by the following :

For 50 volt lamps,

1 lamp, use 1 ampere.					
3 lamps, use 3 ampere.					
5	"	"	5	"	
6 to 8 lamps, use 10 ampere.					
10	" 12	"	"	15	"
15	" 18	"	"	20	"
20	" 30	"	"	30	"
40	" 45	"	"	50	"
50	" 60	"	"	60	"
70	" 80	"	"	80	"
80	" 90	"	"	100	"

For 100 volt lamps,

1 to 2 lamps, use			1	ampere.	
3	" 5	"	"	3	"
5	" 10	"	"	8	"
10	" 15	"	"	10	"
20	" 25	"	"	15	"
30	" 35	"	"	20	"
40	" 50	"	"	30	"
60	" 70	"	"	40	"
80 lamps, use 50 ampere.					
100	"	"	60	"	
120	"	"	80	"	
150	"	"	100	"	
200	"	"	130	"	

30. In placing fuses on secondary circuits, always open the switch on the branch being fused, or turn the lamps "off" at sockets before replacing fuse.

31. When replacing fuses, always test for grounds or short circuits on lines where fuses are blown.

32. Use your fused testing wire for all tests on secondaries, if testing with current. When grounds are found, unless cleared by you, the branch grounded must be left cut out and the office notified.

33. If grounds or short circuits develop on house wires, inform the owner and ascertain if he wants the company to correct the fault at his expense. Report to the office by telephone, if necessary, what trouble is found, and the owner's name, unless you locate and correct the fault. The usual report in writing will be necessary.

34. Always cut out entirely any faulty transformer and report by telephone at earliest moment in the day time, so as to allow as much time as possible to change it.

FIRE RULES.

35. Record all fire alarms on telephone blank, and, when location is discovered, examine the maps, so that you may be familiar with the locations of the circuits in the vicinity should a second alarm call you out.

36. When out, if you discover a serious fire, go at once and see if our lines are likely to be in the way.

37. In answering second alarms, always report to the police captain and the fire chief on your arrival, and inform them where you will likely be found about the fire.

38. If the supervisor of city lighting is on the ground, render him any assistance you can.

39. Don't neglect the company's interest at any time for that of others.

40. Save any property of the company in or near burning buildings only when you can do so without risk to yourselves.

41. Be of such service to the fire chief as you can, so far as it relates to your business.

42. Avoid cutting wires when possible, and arrange to renew the service as soon as possible, if you do cut them.

A thorough knowledge of the circuits will enable you to do your work easier and in a more satisfactory manner to yourselves and the company, than if you fail to acquire this. Study the maps.

DYNAMO DEPARTMENT.

1. The number of lamps on each circuit must be recorded on the circuit board each day.

2. All new city lamps and circuit changes will be made on map board and must be noted in this department.

3. All station employés are requested to study the circuit maps and become familiar with the locations of the different circuits.

4. On receipt of telephone or other message to cut out any circuit for the protection of life and property, do so promptly. On an arc circuit always run the brushes up before pulling plugs on switchboard. On incandescent by cutting in resistance at switch-board to kill the dynamo, then open the switch.

5. When a live circuit opens during a run, the dynamo must be cut out at once and left out until the trouble is located and O. K.'d by lineman or inspector.

6. Circuits ordered open must be marked on board with colored chalk. All other circuits must be marked "O. K." with white chalk. This must be done only by those authorized so to do, and must be reported to man in charge in dynamo room.

7. Never "try" a circuit with dynamo that opens during a run, until the trouble is located, no matter if it "rings" closed.

8. Never connect dynamo to a circuit on which men are at work, without instructions from the men to do so.

9. When an arc light or motor circuit is reported "O. K." after it has been open, build up current very slowly at dynamo by hand, and take about five minutes to put full current on, because it frequently happens that linemen will leave their work and start out on a circuit looking for trouble, without first notifying the station. By starting the circuit in this manner, should they be in a position where they might feel the current, they would likely have warning before current reached a dangerous intensity.

10. Never run two machines in series. Doing this will be sufficient cause for dismissal. No excuse will be accepted for disobedience of this rule.

11. Rubber mats and gloves must be used when working the switchboard. The same rule applies to work on dynamos when running.

12. An arc made by electricity can frequently be blown or whipped out with a towel, on continuous current circuits, and should be extinguished in that manner if the connections which occasion the arc cannot be easily separated.

13. In the event of a short circuit on alternating lines or switches in station, the current can be safely shut off by cutting in resistance on exciter at switchboard.

14. Water will not extinguish an electric arc or fire when produced only by the current.

15. Large canvas covers are available, which should be quickly spread over the dynamos if water is used to extinguish fire on the floor above.
16. Fire buckets must be kept filled with both sand and water on each floor in machine building above engine room. In many cases sand will prove more useful than water in extinguishing a fire. The hose on each floor must be kept connected and ready for use.
17. In using sand or water, remember that a little directed is better than quantities thrown wildly. Use no more of either than is absolutely necessary, as it is easy to do more damage with them than would be likely by fire.
18. Any faulty lamps, wires, belts or anything else reported to this department must have immediate attention from the man in charge.
19. Always report to the general manager by telephone, at his office or residence, anything whatever which he should know. Do this promptly.
20. None but employés are permitted in the building without a pass. Men in charge are requested to respectfully enforce this rule.
21. Smoking is absolutely forbidden.
22. Always record all telephone messages.
23. Read all other rules, part of which apply particularly to this department, and a knowledge of them is required of you.

SHAFTING FLOOR.

1. Permit no one here, except on business.
2. Do not approach the shaft between the pulleys while it is running, particularly that portion of the shaft where the clutches are carried, except when it is necessary to examine the bearings. Then be careful that you have plenty of clearance between your body and the edge of the running pulley or clutch mechanism.
3. You must not wear loose or flapping clothing. Be careful that your sleeve does not hang down and that your jacket is worn buttoned.
4. Notify the dynamo tender in charge if a belt is flapping or jumping too much, or of any defects in the belts. Should a clutch slip, notify him so that it may be thrown out if possible until it can be cared for.
5. Never clean shafting while it is running.
6. Examine daily your grease cups and see that they are in working order, and be sure that all standing pulleys on running shafts are well lubricated. Before examining these, inform the dynamo tenders, so that they will not throw the clutch in while you are about the pulleys.
7. Keep your machinery clean and your floor free from dirt.
8. All towels, clean or dirty, must be kept in the cabinet provided for them.
9. The hose on this floor must always be connected ready for use in case of fire, and fire buckets must be kept well filled.
10. In the event of fire, avoid throwing water on belts. Use as little as possible, on account of injury to belts and machinery below.
11. Report immediately to engineer on duty any machinery which appears defective or in any manner out of order; also make written report of same to chief engineer.
12. All engine belts must be "slacked off" when engine is stopped.
13. If dynamo belts are left tight, notify the man in charge of dynamo floor, or the engineer in charge.
14. If you notice any wires out of place or in trouble, report immediately to the man in charge of dynamos.
15. Do not handle any wires.
16. Smoking is absolutely forbidden.
17. Read all rules as well as those of your department.

ENGINE ROOM.

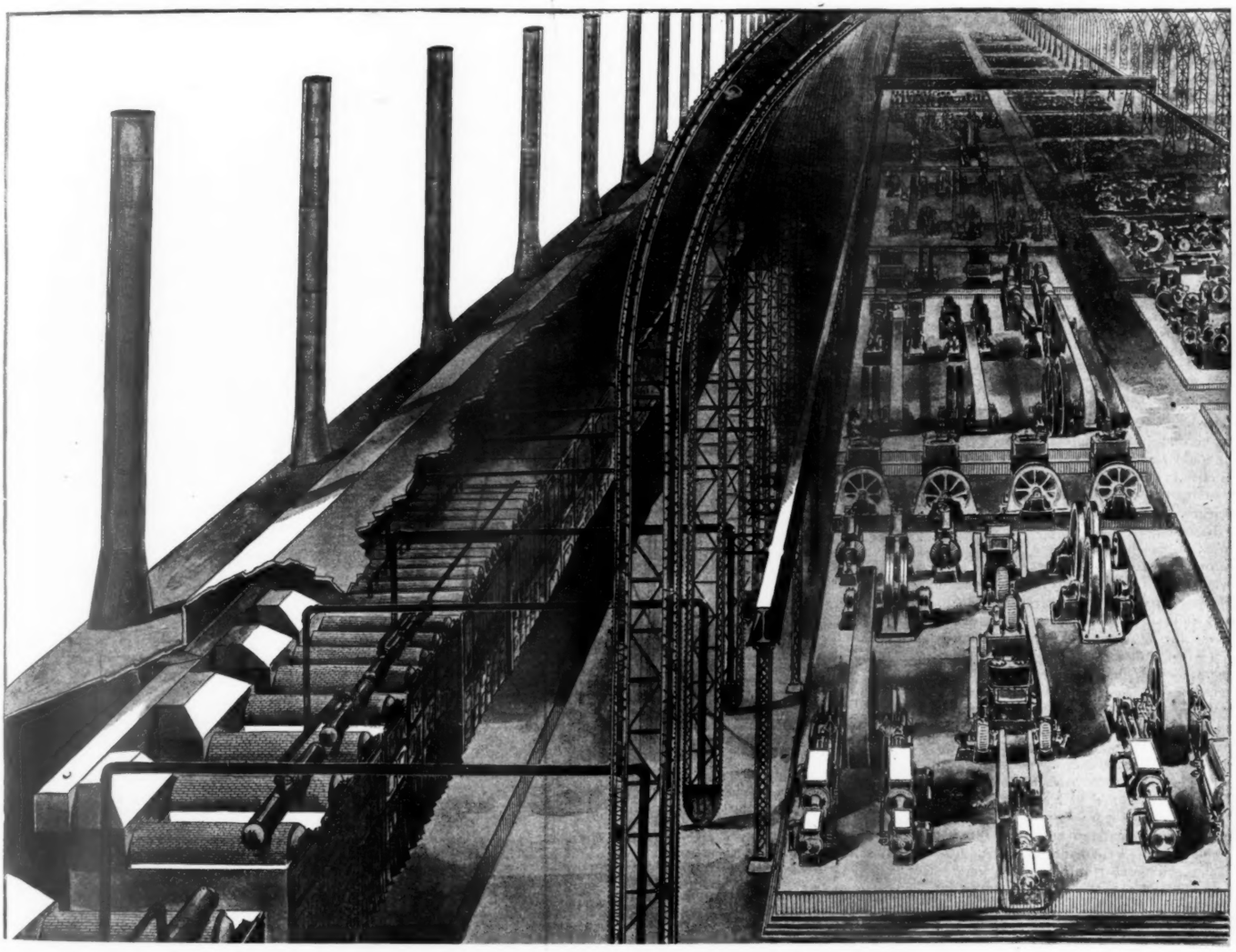
1. No one, except employés whose business requires it, is permitted in this room without permission of the chief engineer, or a pass from the office; then only at their own risk.
2. No one must be permitted about the machinery whose business does not require it.
3. All are cautioned to use the greatest care when about the engines to avoid accident. Loose or flapping clothing must not be worn, and jumpers or jackets must be worn buttoned.
4. Anything unusual must be reported to the chief engineer at once, or the engineer in charge.
5. In the boiler or engine room, or anywhere else, avoid contact in any manner with wires or lamps.
6. Faulty lamps or other electrical apparatus must be reported at once to the one in charge of dynamo floor.
7. Dynamos or wires on engine floor must not be handled by others than the engineer in charge or the man in charge of dynamo floor, and then only in the manner indicated in the rules for the dynamo department.
8. Should it be necessary, in case of accident, you can instantly stop the alternating current from any machine by throwing the small exciter belt, or by cutting or pulling loose one of the wires from the small exciter which is driven by the machine from which the current should stop. This can be done without danger.

JAS. I. AYER,
General Manager.

St. Louis, September, 1892.

The Power Plant at the World's Fair.

Readers of the ELECTRICAL REVIEW who visit the World's Fair will find their interest attracted to the southern side of Machinery Hall, where are to be assembled the engines and boilers, which, besides serving as a most interesting exhibit in themselves, will develop about 25,000 horse-power, to be electrically transmitted all over the exhibition as light and power. A space 100 feet in width and 1,000 feet long has been assigned to the engines, while an adjoining building 627 feet long and 86 feet wide is devoted to the boilers. The space devoted to the engines and dynamos constitutes about one-fourth of the floor space of Machinery Hall. A perspective view is shown in the engraving, for which we are indebted to *Power*.



VIEW OF THE POWER PLANT AT THE WORLD'S COLUMBIAN EXPOSITION, CHICAGO.

Electric Signaling to Balloons.

BY A LONDONER.

A reliable method of signaling at altitudes for military and naval purposes has for many years been recognized as essential, and it is generally understood that no army or navy can be said to be properly equipped without some such arrangement. A system which, it is claimed, is superior to those methods of signaling by reflecting intermittent beams of light upon the clouds, by means of rockets, or by captive balloons, with flags, lanterns, etc., was described in detail on January 27, before the Royal United Service Institution, by the inventor, Mr. Eric Stuart Bruce. The principal features of the system lie in the fact that the car of the balloon is dispensed with, and the signals are flashed by electricity to the captive balloon. Thus, by this arrangement, a balloon can be used for signaling and of such a size as to be portable, quickly inflated and easily manipulated. The balloon is made of thin cambric, and is coated with a varnish of a light color, thus forming an exceedingly translucent medium. The balloon is filled with pure hydrogen or coal gas, and contains usually six incandescent lamps, which are connected by means of a cable to a source of electricity on the ground; and in the circuit on the ground is an apparatus for making and breaking contact rapidly. It will readily be understood that, by varying the duration of the flashes of light in the balloon, it is possible to signal according to the Morse or any other code. To show the facility with which this can be accomplished, Mr. Bruce, by means of a model balloon, caused the sentence "Bridge repaired" to be flashed to it. The signals were transmitted by means of a key resembling, though differing from, a Morse key. It has carbon contacts which can easily be renewed at slight expense, and that type of key has been adopted by the Belgian government. The key is arranged on a switchboard, so that the current can be turned on to the lamps in the balloon either through the key or directly for continuous illumination. The speed of signaling depends upon the thickness of the carbon filaments in the lamps, and by the use of very thin filaments it was possible to attain considerable speed. The lamps are suspended inside the balloon in a holder resembling a ladder; they are of eight candle-power nominally, but give good results when worked up to 16 candle-power. When tested at the Albert Palace, Battersea, the signals from a balloon fitted with six 8 candle-power lamps were visible at Elsbridge, a distance of 16 miles. From his experience, Mr. Bruce has found that the continuous flashing of the lamps does not shorten their life. He uses storage cells for energizing the lamps; the battery consists of 25 cells, weighing 5½ cwts., and occupying a space of three feet by one foot eight inches. The hydrogen gas employed for inflating the balloon is compressed and carried in cylinders. Several balloons on this system have been made, and one has been tested by government officials at Chatham. Mr. Bruce concluded his description by making various interesting experiments to show the absolute safety of the arrangement of incandescent lamps in a balloon filled with gas, and the hope was expressed that the government would adopt the system.

The Union Railway Company, of Providence, with its extensive system, but with only a few miles of trolley line, will possibly pass for the time being into the hands of the Narragansett Electric Lighting Company. The power station of the latter concern is said to be sufficient to run all the horse cars for miles about Providence, and to furnish illuminating supplies to the whole State.

An Electrical Bonanza!

A "REVIEW" CORRESPONDENT DISCOVERS ONE THAT HAS THE "ELECTRIC CURRENT BY THE EAR" IN SPRINGFIELD, MASS.—A FEW SHARES OF STOCK FOR SALE.

A new planet, and one of the first magnitude at that, has appeared in the electrical firmament, which, unless all predictions fail, is destined to throw the entire galaxy of stars into deepest gloom. Even the "Wizard of Menlo Park" must prepare to resign his laurels for the decoration of a nobler brow, and be content for the future with a reflected glory.

This phenomenon of the nineteenth century was first discovered in the modest little city of Springfield, Mass., and your correspondent, being on the spot and hearing vague rumors of his presence, rashly undertook to make some investigations in the cause of science. Being informed that the temporary headquarters of genius were at 14 Taylor street, he ambled in that direction, and though with some trepidation, sought the presence of the individual who is responsible for the "Greatest Invention Known to Electrical Engineering," in other words, the mighty Wilkins himself.

Nothing of an alarming nature was encountered at the start, the only visible occupants of the room being a small line of shafting in course of construction and nearby a rather peculiar looking individual, chiefly remarkable from the fact that his head had evidently not been built for his hat; or, if so, the head had contracted several inches since they were first joined together.

Somewhat reassured by appearances, and judging from these observations that the individual before him could not be the one sought, your correspondent ventured to ask in a mild way if he was in the vicinity. A voice from the depths of the before-mentioned hat replied that Mr. Wilkins was not in, but that if any information was desired he could readily supply it, being a practical electrician of some four years' standing, and thoroughly posted in all branches of the science.

Replying to a question as to who Mr. Wilkins was, he volunteered the startling information that "Mr. Wilkins is the man who has got the electric current by the ear!" Having partially recovered from this shock, and while still conscious of a feeling of extreme thankfulness that Mr. Wilkins was *not* present, the seeker after news managed to ask by what means this result had been accomplished, and was informed that the "Multiple Electric Meter and Governor" was the thing that did the business. His consuming curiosity to get a sight of this wonderful machine was not gratified, however, as none were on hand for inspection, but as a partial offset to this disappointment he was bombarded with a volley of facts concerning it, among which were that "it could regulate a current of any strength to the exact amount requisite for the work to be performed, so that not a single volt would go to waste." "That it had saved the West End Street Railway Company, of Boston, just 84 tons of coal in one day." "That a representative of the said company had traveled to Springfield with a blank check in his pocket ready to be filled up for any amount necessary for the purchase of the invention." "That the State of New York had offered a royalty of $100,000 for the exclusive use of the meter within its boundaries," etc., etc., until the inflation beneath the hat gave out and it collapsed into a chair.

Being asked why some of these seemingly rather good offers had not been accepted, the hat scornfully replied, "What do you think! He's no fool, he wants to make something for himself, don't he?" This ended all argument, so far as the unfortunate questioner was concerned, he being paralyzed by the extent of his ignorance. Just before his exit from the scene he was invited to invest in some shares of the capital stock of the company, the total of which, as at present organized is $250,000. The greater part of this goes to pay for the patents, which cover the entire world. He was also informed that "In the near future, as the business developes, the company will have to be reorganized with greater capital."

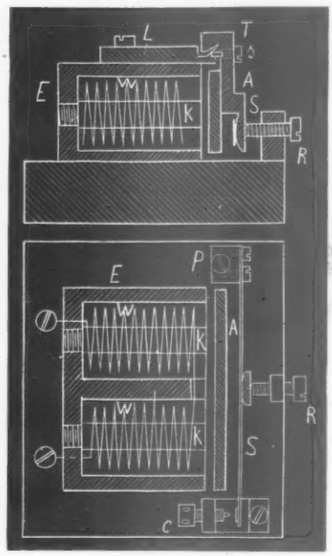
After being obliged to confess that he had left his pocketbook at the hotel, and regretted not being able to take advantage of this golden opportunity to "get the electric current by the ear," your correspondent was allowed to depart, a sadder, if not a wiser man, and wondering how many of that class of individuals, one of which it is generally believed is born every minute, would be caught by this enterprising angler.

February 25, 1893. H. G. T.

A New Relay, Patented by Messrs. Siemens & Halske.

The inventors have tried for many years to improve the working of relays employed in rapid telegraphy. One of the principal drawbacks which recent inventors have tried to overcome is the high self-induction of relays. Upon remedying this evil, it became apparent that apparatus constructed on such a principle possessed only a low degree of practical efficiency.

Messrs. Siemens & Halske believe they have overcome the disadvantage by the following construction, which is clearly outlined in the subjoined drawings, taken from the German patent of Messrs. Siemens & Halske, No. 68,873, granted October 8, 1891.



It will be seen that the iron cylinder E contains two borings of equal diameter W W. Screwed firmly into the bottom of these tubes are two adjustable soft iron cores, K K. The fact that the coils are enclosed in an iron shell considerably reduces their self-induction, which is furthermore decreased by using comparatively few convolutions. Opposite the end of the cores K K is the armature A, consisting of a flat piece of iron. Screwed to A is another piece of iron having two right angular extensions, of which the upper one, T, is poised on a knife edge formed upon the auxiliary iron piece L. The lower right angular extension, which is convex on its inside, slides over a spring F, which in turn is fastened to P and serves as a make and break key. The small screw, S, prevents the entire removal of A from L. The contact screw R presses against S, while opposite the free end of S projects another contact screw C. As soon as the current flows through the coils W W, A is attracted, causing S to come in contact with the spring F. The free end of the latter then touches C, closing the circuit. But the pressure exerted by S upon F produces a friction against C and a quick falling off of the armature when the current intermits. It is stated that this peculiar form of relay is extremely sensitive and may be employed with good results in rapid telegraphy.

The inhabitants of Beverly, Mass, voted by a large majority for allowing the electric car system to be installed in their city. The victory for the electrics was received with demonstrations of joy all over the town. Salem, Wenham, Hamilton, Ipswich and Rawley, Mass., are also rejoicing over the vote.

The Famous Bell Patent.

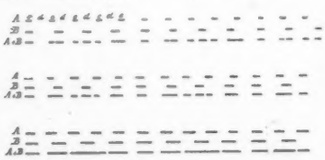
THE PATENT OF ALEXANDER GRAHAM BELL, WHICH EXPIRES MARCH 7, 1893—IT WAS CALLED "IMPROVEMENT IN TELEGRAPHY," AS THE WORD "TELEPHONE" WAS NOT A FAMILIAR ONE AT THAT TIME—ILLUSTRATIONS AND SPECIFICATIONS.

On March 7, 1876, the United States Patent Office issued to Alexander Graham Bell, of Salem, Mass., a patent on "Improvement in Telegraphy," the application having been filed February 14 of the same year—a very quick piece of work on the part of the office. As this patent is of particular historical value, and as its death will surely occur on the 7th of this month, we reproduce it with drawings below. The italics are our own. Who could have dreamed of their importance! The wonderful things that developed from this invention are, we believe, without a parallel in history:

To all whom it may concern:

Be it known that I, ALEXANDER GRAHAM BELL, of Salem, Massachusetts, have invented certain new and useful improvements in Telegraphy, of which the following is a specification:

In Letters Patent granted to me April 6, 1875, No. 161,739, I have described a method of, and apparatus for, transmitting two or more telegraphic signals simultaneously along a single wire by the employment of transmitting instruments, each of which occasions a succession of electrical impulses differing in rate from the others; and of receiving instruments, each tuned to a pitch at which it will be put in vibration to produce its fundamental note by one only of the transmitting instruments; and of vibratory circuit-breakers operating to convert the vibratory movement of the receiving instrument into a permanent make or break (as the case may be) of a local circuit in which is placed a Morse sounder, register, or other telegraphic apparatus. I have also therein described a form of autograph-telegraph based upon the action of the above-mentioned instruments.



FIGS. 1, 2 & 3.—BELL'S FIRST TELEPHONE PATENT.

In illustration of my method of multiple telegraphy I have shown in the patent aforesaid, as one form of transmitting instrument, an electro-magnet having a steel-spring armature, which is kept in vibration by the action of a local battery. This armature in vibrating makes and breaks the main circuit, producing an intermittent current upon the line wire. I have found, however, that upon this plan the limit to the number of signals that can be sent simultaneously over the same wire is very speedily reached; for, when a number of transmitting instruments, having different rates of vibration, are simultaneously making and breaking the same circuit, the effect upon the main line is practically equivalent to one continuous current.

In a pending application for Letters Patent, filed in the United States Patent Office, February 25, 1875, I have described two ways of producing the intermittent current—the one by actual make and break of contact, the other by alternately increasing and diminishing the intensity of the current without actually breaking the circuit. The current produced by the latter method I shall term, for distinction

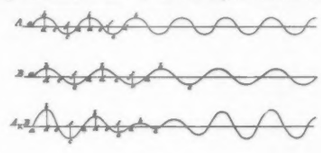


FIG. 4.

sake, a pulsatory current.

My present invention consists in the employment of a vibratory or undulatory current of electricity in contradistinction to a merely intermittent or pulsatory current, and of a method of, and apparatus for, producing electrical undulations upon the line wire.

The distinction between an undulatory and a pulsatory current will be understood by considering that electrical pulsations are caused by sudden or instantaneous changes of intensity, and that electrical undulations result from gradual changes of intensity exactly analogous to the changes in the density of air occasioned by simple pendulous vibrations. The electrical movement, like the aerial motion, can be represented by a sinusoidal curve or by the resultant of several sinusoidal curves.

Intermittent or pulsatory and undulatory currents may be of two kinds, accordingly as the successive impulses have all the same polarity or are alternately positive and negative.

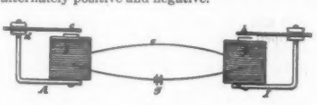


FIG. 5.

The advantages I claim to derive from the use of an undulatory current in place of a merely intermittent one are, first, that a very much larger number of signals can be transmitted simultaneously on the same circuit; second, that a closed circuit and a single main battery may be used; third, that communication in both directions is established without the necessity of special induction coils; fourth, that cable dispatches may be transmitted more rapidly than by means of an intermittent current or by the methods at present in use; for, as it is unnecessary to discharge the cable before a new signal can be made, the lagging of cable signals is prevented; fifth, and that as the circuit is never broken a spark arrester becomes unnecessary.

It has long been known that when a permanent magnet is caused to approach the pole of an electro-magnet a current of electricity is induced in the coils of the latter, and that when it is made to recede a current of opposite polarity to the first appears upon the wire. When, therefore, a permanent magnet is caused to vibrate in front of the pole of an electro-magnet an undulatory current of electricity is induced in the coils of the electro-magnet, the undulations of which correspond, in rapidity of succession, to the vibrations of the magnet, in polarity to the direction of its motion, and in intensity to the amplitude of its vibration.

That the difference between an undulatory and an intermittent current may be more clearly understood, I shall describe the condition of the electrical current when the attempt is made to transmit two musical notes simultaneously—first upon the one plan and then upon the other. Let the interval be-

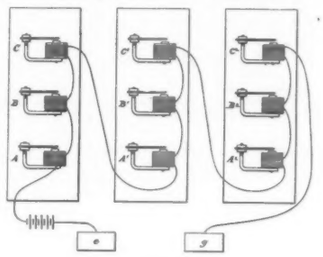


FIG. 6.

tween the two sounds be a major third; then their rates of vibration are in the ratio of 4 to 5. Now, when the intermittent current is used the circuit is made and broken four times by one transmitting instrument in the same time that five makes and breaks are caused by the other. A and B, Figs. 1, 2 and 3, represent the intermittent currents produced, four impulses of B being made in the same time as five impulses of A. *c c c*, etc., show where and for how long time the circuit is made, and *d d d*, etc., indicate the duration of the breaks of the circuit. The line A and B shows the total effect upon the current when the transmitting instruments for A and B are caused simultaneously to make and break the same circuit. The resultant effect depends very much upon the duration of the make relatively to the break. In Fig. 1 the ratio is as 1 to 4; in Fig. 2 as 1 to 2; and in Fig. 3 the makes and breaks are of equal duration. The combined effect, A and B, Fig. 3, is very nearly equivalent to a continuous current.

When many transmitting instruments of different rates of vibration are simultaneously making and breaking the same circuit the current upon the main line becomes for all practical purposes continuous.

Next, consider the effect when an undulatory current is employed. Electrical undulations, induced by the vibration of a body capable of inductive action, can be represented graphically, without error, by the same sinusoidal curve which expresses the vibration of the inducing body itself, and the effect of its vibration upon the air; for, as above stated, the rate of oscillation in the electrical current corresponds to the rate of vibration of the inducing body—that is, to the pitch of the sound produced. The intensity of the current varies with the

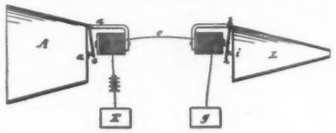


FIG. 7.

amplitude of the vibration—that is, with the loudness of the sound; and the polarity of the current corresponds to the direction of the vibrating body—that is, to the condensations and rarefactions of air produced by the vibration. Hence, the sinusoidal curve, A or B, Fig. 4, represents, graphically, the electrical undulations induced in a circuit by the vibration of a body capable of inductive action.

The horizontal line *a d e f*, etc., represents the zero of current. The elevations *b b b*, etc., indicate impulses of positive electricity. The depressions *c c c*, etc., show impulses of negative electricity. The vertical distance *b d* or *c f* of any portion of the curve from the zero line expresses the intensity of the positive or negative impulse at the part observed, and the horizontal distance *a a* indicates the duration of the electrical oscillation. The vibrations represented by the sinusoidal curves B and A, Fig. 4, are in the ratio aforesaid of 4 to 5—that is, four oscillations of B are made in the same time as five oscillations of A.

The combined effect of A and B, when induced simultaneously on the same circuit, is expressed by the curve A+B, Fig. 4, which is the algebraical sum of the sinusoidal curves A and B. This curve, A+B also indicates the actual motion of the air when the two musical notes considered are sounded simultaneously. Thus, when electrical undulations of different rates are simultaneously induced in the same circuit, an effect is produced exactly analogous to that occasioned in the air by the vibration of the inducing bodies. Hence, to co-existence upon a telegraphic circuit of the electrical vibrations of different pitch is manifested, and by the obliteration of the vibratory character of the current, but by peculiarities in the shapes of the electrical undulations, or, in other words, by peculiarities in the shapes of the curves which represent those undulations.

There are many ways of producing undulatory currents of electricity, dependent for effect upon the vibrations or motions of bodies capable of inductive action. A few of the methods that may be employed I shall here specify. When a wire, through which a continuous current of electricity is passing, is caused to vibrate in the neighborhood of another wire, an undulatory current of electricity is induced in the latter. When a cylinder, upon which are arranged bar magnets, is made to rotate in front of the pole of an electro-magnet, an undulatory current of electricity is induced in the coils of the electro-magnet.

Undulations are caused in a continuous voltaic current by the vibration or motion of bodies capable of inductive action; or by the vibration of the conducting wire itself in the neighborhood of such bodies. Electrical undulations may also be caused by alternately increasing and diminishing the resistance of the circuit, or by alternately increasing and diminishing the power of the battery. The internal resistance of a battery is diminished by bringing the voltaic elements nearer together,

and increased by placing them farther apart. The reciprocal vibration of the elements of a battery, therefore, occasions an undulatory action in the voltaic current. The external resistance may also be varied. For instance, let mercury or some other liquid form part of a voltaic circuit, then the more deeply the conducting wire is immersed in the mercury or other liquid, the less resistance does the liquid offer to the passage of the current. Hence the vibration of the conducting wire in mercury or other liquid included in the circuit occasions undulations in the current. The vertical vibrations of the elements of a battery in the liquid in which they are immersed produces an undulatory action in the current by alternately increasing and diminishing the power of the battery.

In illustration of the method of creating electrical undulations, I shall show and describe one form of apparatus for producing the effect. I prefer to employ for this purpose an electro-magnet, A, Fig. 5, having a coil upon only one of its legs *b*. A steel spring armature, *c*, is firmly clamped by one extremity to the uncovered leg *d* of the magnet, and its free end is allowed to project above the pole of the covered leg. The armature *c* can be set in vibration in a variety of ways, one of which is by wind, and in vibrating, it produces a musical note of a certain definite pitch.

When the instrument A is placed in a voltaic circuit, *g b e f g*, the armature *c* becomes magnetic, and the polarity of its free end is opposed to that of the magnet underneath. So long as the armature *c* remains at rest, no effect is produced upon the voltaic current, but the moment it is set in vibration to produce its musical note a powerful inductive action takes place, and electrical undulations traverse the circuit *g b e f g*. The vibratory current passing through the coil of the electro-magnet *f* causes vibration in its armature *h* when the armatures *c h* of the two instruments A I are normally in unison with one another; but the armature *h* is unaffected by the passage of the undulatory current when the pitches of the two instruments are different.

A number of instruments may be placed upon a telegraphic circuit, as in Fig. 6. When the armature of any one of the instruments is set in vibration all the other instruments upon the circuit which are in unison with it respond, but those which have normally a different rate of vibration remain silent. Thus if A, Fig. 6, is set in vibration, the armatures of A^1 and A^2 will vibrate also, but all the others on the circuit will remain still. So if B^3 is caused to emit its musical note the instruments B B^2 respond. They continue sounding so long as the mechanical vibration of B^1 is continued, but become silent with the cessation of its motion. The duration of the sound may be used to indicate the dot or dash of the Morse alphabet, and thus a telegraphic dispatch may be indicated by alternately interrupting and renewing the sound.

When two or more instruments of different pitch are simultaneously caused to vibrate, all the instruments of corresponding pitches upon the circuit are set in vibration, each responding to that one only of the transmitting instruments with which it is in unison. Thus the signals of A, Fig. 6, are repeated by A^1 and A^2, but by no other instrument upon the circuit; the signals of B^2 by B and B^1; and the signals of C^1 by C and C^2—whether A, B^2, and C^1 are successively or simultaneously caused to vibrate. Hence by these instruments two or more telegraphic signals or messages may be sent simultaneously over the same circuit without interfering with one another.

I desire here to remark that there are many other uses to which these instruments may be put, such as the simultaneous transmission of *musical notes*, differing in loudness as well as in pitch, and the telegraphic *transmission of noises or sounds of any kind*.

When the armature *e*, Fig. 5, is set in vibration the armature *h* responds not only in pitch, but in loudness. Thus, when *c* vibrates with little amplitude, a very soft musical note proceeds from *h*, and when *c* vibrates forcibly the amplitude of the vibration of *h* is considerably increased, and the resulting sound becomes louder. So, if A and B, Fig. 6, are sounded simultaneously (A loudly and B softly), the instruments A^1 and A^2 repeat loudly the signals of A, and B^1 B^3 repeat softly those of B.

One of the ways in which the armature *c*, Fig. 5, may be set in vibration has been stated above to be by wind. Another mode is shown in Fig. 7, whereby motion can be imparted to the armature by the human voice or by means of a musical instrument.

The armature *c*, Fig. 7, is fastened loosely by one extremity to the uncovered leg *d* of the electro-magnet *b*, and its other extremity is attached to the center of a stretched membrane, *a*. A cone, A, is used to converge sound vibrations upon the membrane. When a sound is uttered in the cone the membrane *a* is set in vibration, the armature *c* is forced to partake of the motion, and thus electrical undulations are created upon the circuit E *b e f g*. These undulations are similar in form to the air vibrations caused by the sound—that is, they are represented graphically by similar curves.

The undulatory current passing through the electro-magnet *f* influences its armature *h* to copy the motion of the armature *c*. A similar sound to that uttered into A is then heard to proceed from L.

In this specification the three words "oscillation," "vibration" and "undulation" are used synonymously, and in contradistinction to the terms "intermittent" and "pulsatory." By the terms "body capable of inductive action" I mean a body which, when in motion, produces dynamical electricity. I include in the category of bodies capable of inductive action brass, copper and other metals, as well as iron and steel.

Having described my invention, what I claim and desire to secure by letters patent is as follows:

1. A system of telegraphy in which the receiver is set in vibration by the employment of undulatory currents of electricity, substantially as set forth.

2. The combination, substantially as set forth, of a permanent magnet or other body capable of inductive action, with a closed circuit, so that the vibration of the one shall occasion electrical undulations in the other, or in itself, and this I claim, whether the permanent magnet be set in vibration in the neighborhood of the conducting wire forming the circuit, or whether the conducting wire be set in vibration in the neighborhood of the permanent magnet, or whether the conducting wire and the permanent magnet both simultaneously be set in vibration in each other's neighborhood.

3. The method of producing undulations in a continuous voltaic current by the vibration or motion of bodies capable of inductive action, or by the vibration or motion of the conducting wire itself, in the neighborhood of such bodies, as set forth.

4. The method of producing undulations in a continuous voltaic circuit by gradually increasing and diminishing the resistance of the circuit, or by gradually increasing and diminishing the power of the battery, as set forth.

5. The method of, and apparatus for, *transmitting vocal or other sounds* telegraphically, as herein described, by causing *electrical undulations*, similar in form to the vibrations of the air accompanying the said vocal or other sound, substantially as set forth.

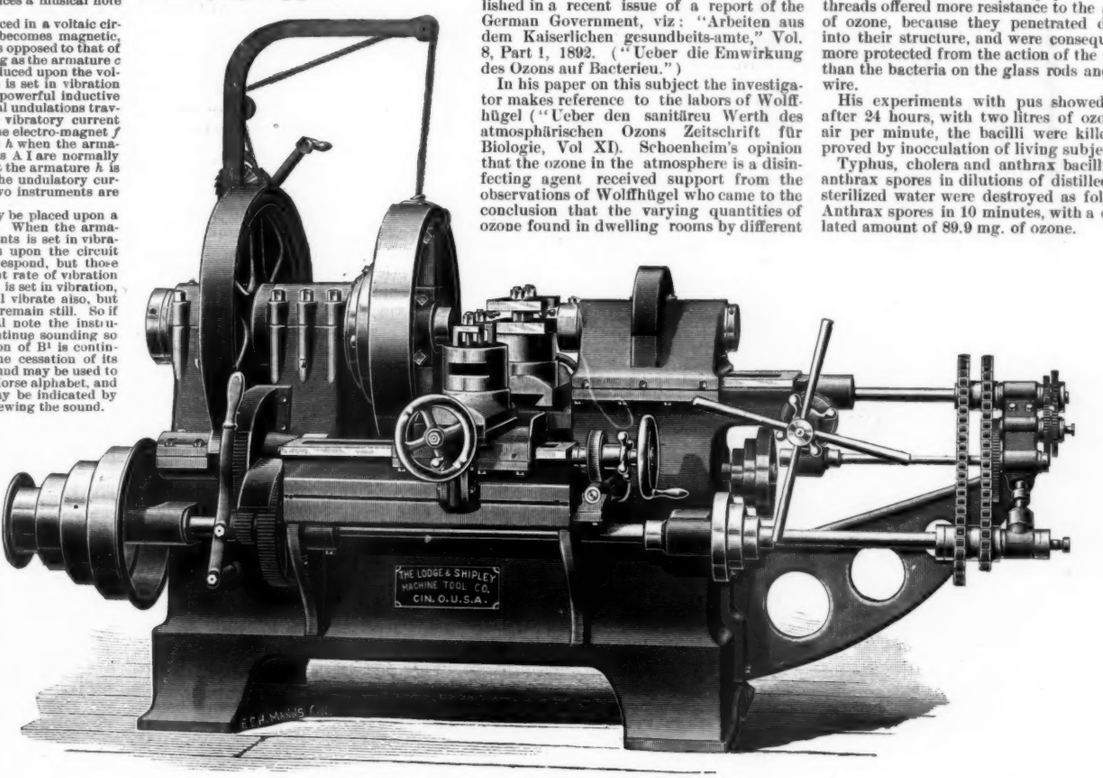
In testimony whereof I have hereunto signed my name this 20th day of January, A. D. 1876.

ALEX. GRAHAM BELL.

Witnesses:
THOMAS E. BARRY,
P. D. RICHARDS.

Lodge & Shipley's 30-Inch Motor Gear Lathe.

The lathe herewith illustrated is manufactured by the Lodge & Shipley Machine Tool Company, of Cincinnati, O., for the rapid production of gears, such as are used on street railway motors, and on all heavy machinery requiring gears.



MOTOR GEAR LATHE FOR ELECTRICAL MANUFACTURING.

The 30-inch motor gear lathe will, at the same operation, bore, square and turn blank gears to 30 inches diameter, and will admit pieces of that diameter by a 24-inch face.

The saddles are driven by means of screws, the rear one being provided with power cross feed. The front tool block is arranged to carry two tools, either of which may be revolved into position. The rear saddle is fitted with a square tool block, on which two tools may be clamped for facing the sides of the rim of the gear at one operation.

The boss on the rear end of the bed is bored to receive this sleeve. The sleeve has a rack cut on its lower side which meshes with a pinion cut on the pilot shaft. On this pilot shaft is a worm wheel and clutch for engaging the power feed. The worm shaft is driven from the tail stock shaft by means of gears. Two feeds are provided, the change from one to the other being made by sliding a key. The tail stock shaft is feathered in a sleeve, which is journaled in a bracket at the rear end of the lathe.

Keyed to this sleeve are two sprocket wheels driven by chains from sprocket wheels on the main driving shaft.

These sprocket wheels run loose on the main shaft, but either may be keyed to it by means of a similar device employed with the feed-gears, thus giving two speeds. The change from one to the other can be readily made or the boring mechanism can be stopped without affecting the head end of the lathe.

The drives and feeds of the boring-bar are all positive. The boring-bar takes a bearing in the live spindle, and is provided with a collet having a self-oiling device. This boring-bar secures an absolutely accurate hole. The drives and feeds of the boring-bar are all positive. The chuck is fitted with clamps and adjusting-screws.

A device is employed for quickly centering the casting to be turned. It consists of a forked rest in the center of the bed, on which rest the work is supported at the proper height to be clamped to the chuck.

The Action of Ozone on Bacteria.

BY J. C. DITTRICH, CHEMIST OF THE OZONE MANUFACTURING COMPANY, NEW YORK.

Scientific men engaged in the investigation of the nature of ozone have not, until recently, been in agreement regarding the reputed prosperity of this modified condition of oxygen to prevent the development of germs, or even entirely destroy them.

The destructive action of ozone on bacteria has, however, been confirmed by the late labors of Dr. Ohlmüller, of the Imperial Board of Health, Berlin, and the results of his exhaustive experiments have been published in a recent issue of a report of the German Government, viz: "Arbeiten aus dem Kaiserlichen gesundbeits-amte," Vol. 8, Part 1, 1892. ("Ueber die Emwirkung des Ozons auf Bacterieu.")

In his paper on this subject the investigator makes reference to the labors of Wolffhügel ("Ueber den sanitäreu Werth des atmosphärischen Ozons Zeitschrift für Biologie, Vol XI). Schoenheim's opinion that the ozone in the atmosphere is a disinfecting agent received support from the observations of Wolffhügel who came to the conclusion that the varying quantities of ozone found in dwelling rooms by different observers were due to the presence in greater or smaller amount of organic impurities in the air. Fox (in "Ozone and Antozone," p. 268) also confirms this view. The correctness of this assumption was proved by experiment; 155 litres of air taken from the open, indicated on the ozonoscope a coloration corresponding to VI of the scale. A similar quantity of air passed through an endiometer, into which dust from the street had been blown, showed only a coloration corresponding to III-IV of the scale. This dust, after calcination with soda-lime, gave a strong ammonia reaction. A sample of the dust, thus treated, was exposed to the action of 216 litres of air, and gave, in passing through the endiometer, a coloration corresponding to V of the Ozonoscope scale. A control experiment with another endiometer, and without dust, gave the same scale, V, demonstrating that the organic matter in the dust absorded ozone from the air.

Ohlmüller attributes the many failures in attempts to ozonize the air of sick rooms to the comparatively insignificant amount of ozone employed, which, consequently, was insufficient to completely destroy the organic matter present in them. He is also of opinion that the cause of the failures and the varying observed results of Grossmann, Meyerhausen, Szpilmann, Fischer, Oberdörffer, Sonntag, Oerum, Wissokowitsch, Krukowitsch, Lukasehewitsch and others was due to the relatively small quantities of ozone they had at disposal for their experiments.

For this reason it was of importance to determine under what conditions ozone acts on bacteria, especially as a favorable opportunity presented itself for obtaining ozone in unlimited quantity, generated by means of electricity.

Ohlmüller found, as the result of his researches, that if the bacteria and the ozone be dry, no effect of the ozone on the baeteria was apparent.

With bacteria dry and the ozone moist, typhus bacilli were destroyed in 30 minutes with 46 litres of ozonized air.

Duration of action. Min.	Amount of air used. Litres.	—Typhus bacilli on— Silk threads.	Paper strips.
0	0	+	+
15	22	+	+
30	46	+	+
45	69	—	—
" 60	90	—	—

+ Indicates growth in bouillon.
— Indicates no growth in bouillon.

With ozone and bacteria both moist, typhus bacilli were destroyed in one hour, 108 litres of air being consumed.

Duration of action. Minutes.	Amt. of air used Litres.	Filter paper.	Silk threads.	Glass rods.	Iron wire.
0	0	+	+	+	+
15	32	+	+	+	+
30	57	+	+	+	+
45	83	+	+	+	—
1 hour.	108	+	+	+	—
18 "	—	—	—	—	—

The bacteria on the filter paper and silk threads offered more resistance to the action of ozone, because they penetrated deeper into their structure, and were consequently more protected from the action of the ozone than the bacteria on the glass rods and iron wire.

His experiments with pus showed that after 24 hours, with two litres of ozonized air per minute, the bacilli were killed, as proved by inoculation of living subjects.

Typhus, cholera and anthrax bacilli, and anthrax spores in dilutions of distilled and sterilized water were destroyed as follows: Anthrax spores in 10 minutes, with a calculated amount of 89.9 mg. of ozone.

Anthrax bacilli in 10 minutes, with 58 mg. of ozone.

Typhus bacilli in 2 minutes, with 19.5 mg. of ozone.

Cholera bacilli in 5 minutes, with 40.3 mg. of ozone.

Ohlmüller also experimented with sewage and water taken from the river Spree, containing typhus and cholera bacilli, and established the fact that the ozone had a destructive action on the bacteria.

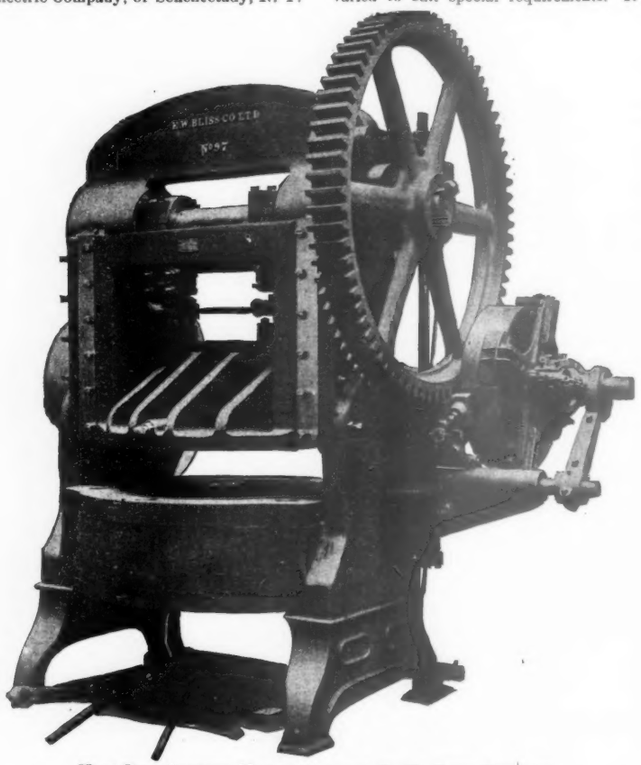
He sums up by stating that the results of his experiments established with *certainty* that ozone has a powerful destructive action on bacteria, if the water containing them is not too strongly contaminated with inanimate organic matter. This destructive action succeeds in like degree when the inanimate organic matter in the water is first oxydized to a certain degree by ozone.

The labors of Ohlmüller possess great significance in view of a possible outbreak of cholera during the coming summer, and in face of the fact that the typhus fever, now prevalent in some parts of the city, may become epidemic. The use of ozone to remedy unsanitary conditions should alone recommend it to the consideration of the authorities, especially as owing to the facility with which ozone can be produced in large quantity, it is now readily available. Machines are now being constructed in New York city, of an ozone capacity to meet the demands of the sanitarian and the medical man, and there seems to be little doubt, from data at hand, that this patient element has, like its sister electricity, been captured to become a handmaid to science, and to aid the hygienist and physician in serving the interests of humanity.

The people in West Berkeley, Cal., are anxious for the Oakland Railway Company to fulfill its contract to lay an electric road out San Pablo avenue to University. This would make a direct and rapid trip into Oakland and would afford business men opportunity to build and live in that pleasant little town.

A New Press for Cutting Armature Discs.

The accompanying cut illustrates a press for cutting out large armature discs, as recently built by E. W. Bliss Company, 133 Plymouth street, Brooklyn, for the General Electric Company, of Schenectady, N. Y.



New Disc Cutting Machine of the E. W. Bliss Company.

The construction of this press embodies a number of special features which have not heretofore been used in connection with presses of this class.

In order to give a firm support and accurate guidance to the large and delicate dies, the ordinary center gib has been abandoned and the ways of the slide are spread apart so as to be as wide as the frame itself. This has also made it possible to lengthen the ways considerably without increasing the height of the frame. The cut show very well the additional solidity and accuracy due to this mode of construction.

Another special feature is the application of a new automatic friction clutch, which obviates entirely many of the difficulties experienced with the regular automatic clutches on heavy back geared presses. Its application and construction will be understood from the cut. A pressure on the foot treadle shown releases the weight, which actuates a powerful friction clutch on the back shaft, thus starting the press almost instantaneously and obviating entirely the heavy metallic blow, which in the ordinary clutches tends to destroy the parts and frequently causes expensive delays and repairs. After the shaft has made one complete revolution a cam releases the friction clutch, bringing into action at the same time a brake and thus stopping the slide at the highest point of stroke.

The large gear wheel, instead of revolving continually, is, with these new clutches, keyed on the shaft, and at a standstill until the clutch is thrown into action. This constitutes an aditional advantage in the saving of considerable wear on the shaft and wheel hub.

There is nothing about these clutches which is liable to get out of order, and for whatever wear may be occasioned by continuous use easy means of compensation are provided.

This press will cut armature discs 30 inches in diameter and larger. It has a distance between the housings of 54 inches, and is generally made with a 30 inch round opening in bed, which, however, can be varied to suit special requirements. It is geared 1:10 and has a fly-wheel weighing 1,800 pounds on the back shaft. The weight is 30,000 pounds.

The E. W. Bliss Company also make a large variety of smaller presses of this class, many of which are now in use in nearly all the large electrical works.

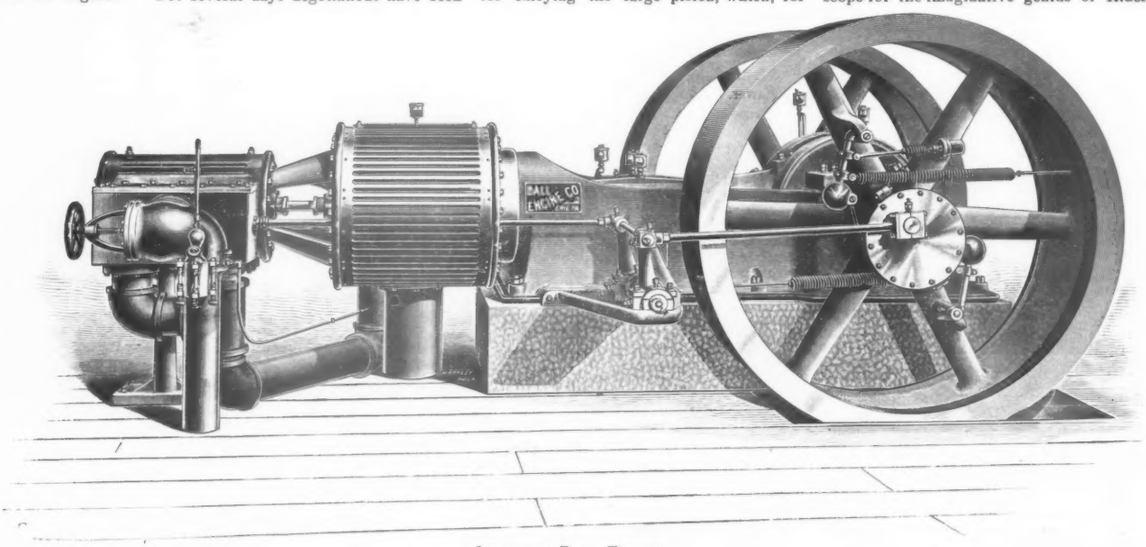
Electric Railway Combinations in Philadelphia.

For several days negotiations have been going on for the purchase of the street railroad lines of Philadelphia. Two of these have already been purchased, one outright by John R. McLean, proprietor of the Cincinnati *Enquirer*, for a quarter of a million dollars. It is rumored that this is but a part of a scheme of a gigantic syndicate in which ex-Secretary Whitney, Colonel Dan Lamont and various other capitalists are interested, and that this syndicate contemplates the control of car lines in Philadelphia, a number of the important roads in New York, Boston and Chicago, while in Baltimore they control the traction system, which is virtually all the roads of that city.

400 Horse-Power Tandem Compound Ball Engine.

The engine herewith illustrated is one of several which have been put in operation within the past year by the Ball Engine Company, of Erie, Pa. It is perfectly balanced and does not require the enormous foundation which its slow speed competitor is obliged to have, one of them giving the most satisfactory results at a speed of 210 revolutions on a pier of its own length, 17 feet high, piercing a comparatively light engine room floor, 14 feet pitch from the basement floor, on which is located all of the steam plant outfit other than the engines and dynamos. This engine is endowed with great strength, rigidity and long living powers, owing to the form of the frame, shaft, cylinders, heads and reciprocating parts, the latter, with the exception of the pistons and wrist pin boxes, being of forged steel from tip to tip. The shaft is of one solid piece of forged steel of a grade that is most excellent for the purpose. The high pressure valve motion is derived from the governor, while the low pressure valve is driven by direct connection from an eccentric on the other side of the engine, this eccentric being adjustable for the purpose of making a more perfect adaptation of the engine to its load when the actual running conditions are demonstrated. The valves of the "nearly" balanced type, are *absolutely* steam tight, and will remain so indefinitely, as the wear is so trifling that a few hours of scraping will renew the faces as good as when first started, after two or three years run of 10 to 18 hours per day. The general features of the engine are suggestive of correct location and distribution of the parts and materials involved. If one will consider the facts existing in a compound engine, it will be found that in the underloaded state the high pressure cylinder does the most work, the total of which does not represent a destructive strain on any of the parts, but as the load increases and gets beyond the medium line, where the work is equal, the force bearing on the low pressure piston becomes greater, and that on the high pressure piston less; hence, the position of the low pressure piston on the rod is of the greatest importance, and in conscientious construction demands that the low pressure cylinder shall be next to the frame for the purpose of better fastening and the superior opportunity for carrying the large piston, which, for security of fastening, must have the larger end of the rod.

The engine shown in our illustration has 18-inch high pressure and 30-inch low pressure cylinders, with 18-inch stroke of pistons, carries two wheels of 96 inches diameter by 25 inches face, weighing 10,000 pounds each, giving a fly-wheel capacity and efficiency equivalent to more than double their weight if made into a 20-foot wheel for a 60-inch stroke engine, making under one-third as many revolutions. It is being demonstrated in this plant that with a regulation giving an increase of speed of one per cent. from empty generators to full capacity (*i. e.* 850 kilowatts), that the voltage taken at 480 when no current is being used will follow the increase of engine speed almost exactly up to the maximum of 500 for full load.



Improved Ball Engine.

LITERARY.

We have received from Secretary Geo. F. Porter, of the National Electric Light Association, the report of the 15th convention of the association, held at Buffalo, N. Y., February 23–25, 1892. The report makes a handsome volume and is from the press of The James Kempster Printing Company.

Charles Scribner's Sons are preparing a novel and interesting contribution to the World's Fair in the form of an "exhibition number" of *Scribner's Magazine*, to be published simultaneously with the opening of the exposition at Chicago. They have planned to make it as fine an example of an American magazine as can be produced by a house to whom the best literary and artistic resources are open. It is not proposed that the text shall relate chiefly to the Fair, but, on the contrary, the leading writers and artists have been asked to contribute to the number what they themselves think will best represent them. The pages of text and illustration will be largely increased and the appearance of the number is likely to be looked for with eagerness by all readers interested in the work of American magazines.

The editors of *Town Topics* invite a new contest for prize stories of from 45,000 to 50,000 words in length, for which the following prizes will be awarded: $1,000 for the first; $300 for the second; $200 for the third. The winners of the second and third prizes will have the privilege of withdrawing their stories, if they do not care to accept the moneys named. The story taking the first prize will be printed with the name of the author in the great summer number of "Tales from Town Topics, No. 8," published June 1. Contestants must have their manuscripts in by April 20, at latest. All manuscripts must be typewritten and inscribed with a *nom de plume*. The name and address of the author are to be enclosed and sealed in a separate envelope. The stories will be read by a committee of five, and when the three best ones are selected, the sealed envelopes will be broken.

A Large Municipality.

Here is a field which will provide ample scope for the imaginative genius of Rider Haggard. The "White City," as the grounds and buildings of the World's Fair are termed, has the equipment of a modern municipality. It is expected that it will soon have a daily water supply of 100,000,000 gallons. At the present time the water equipment consists of 25 miles of water mains and 291 hydrants, but for the supply above stated 100 more hydrants will be provided. There are three steam fire engines, four chemical engines, a ladder truck, water tower, 40 hose carts, 26,750 feet of hose, 1,050 hand fire extinguishers, 2,500 fire pails, a steam fire boat, 65 fire men, 150 alarm boxes, 150 patrol telephones, 500 guards, complete electric light and sewerage system, etc., etc.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

DOYLESTOWN, PA.—The Philadelphia and Allentown Electric Trunk Line Railway will petition the town council for a franchise.

NEVADA, CAL.—A San Francisco company is making preliminary arrangements for constructing an electric railway from Nevada to Marysville, 40 miles distant. A franchise over the county roads has already been obtained.

FINDLAY, OHIO.—The Findlay Electric Street Railway Company will extend its line to Fostoria.

MILLVILLE, N. J.—At a special meeting of city council an application for a street railway franchise was made by the Millville Street Railway Company.

MILWAUKEE, WIS.—The Milwaukee West End Company; capital, $2,500,000. Incorporators, A. B. Myers, Richard Thomas and H. J. West. The object of the company is to erect dwellings, factories, etc., and the construction of a street car line.

HANOVER, MASS.—Capitalists of this town are considering a plan of forming a company to build an electric road through Hanover, connecting with the Rockland and Abington Electric Railway at North Hanover. Hon. Edw. Y. Perry, ex-president of the Hanover Branch Railroad, is at the head of the scheme.

BRISTOL, R. I.—A petition to the general assembly to incorporate an electric railway company to build an electric line from Bristol to East Providence is being circulated. William Williams has charge of the matter.

WICHITA, KAN.—The Wichita Electric Railway Company and the Citizens' Electric Light Company have been consolidated under the name of the Wichita Railway and Light Company, with a paid-up capital of $500,000. These officers have been elected: Chas. E. Duston, president, Middletown, Conn.; A. T. Batchelder, vice-president, Keene, N. H.; J. W. O'Neil, secretary and manager, Wichita.

ASTORIA, ORE.—A company which has been buying up all the electric plants and franchises it could obtain on the coast has secured control of the Astoria street railways and electric light plants.

PHILADELPHIA, PA.—The Federal Street Passenger Railway Company; capital, $20,000.—The Johnson Street Railway Company; capital, $35,000.—The Moore and Mifflin Street Passenger Railway Company; capital, $26,000. The incorporators for the above three lines are John A. Rigg, president; T. B. Foot, H. C. Murphy, Nelson Sailer and Chas. S. Whiting.

CHICAGO, ILL.—The Chicago, Niles and Norwood Rapid Transit Company; capital, $500,000. Incorporators, F. A. Bingham, Robert Ceder and John P. Maes. The company proposes to build a single or double track electric railway from Chicago to Niles and Norwood, and to furnish heat, light and power along the route.

SEWICKLEY, PA.—The Sewickley Valley Passenger Railway Company; capital, $100,000. Directors, F. J. Tener, president, Osborne, and W. B. Rommel, of Pittsburgh, and others.

GREENPORT, N. Y.—A project is on foot to establish an electric railroad between Greenport and Orient, L. I. It is proposed to increase the capital stock of the Greenport Electric Light and Power Company, build the road and supply the motive power from the plant of the company.

PEORIA, ILL.—The Peoria Street Railway Company; capital, $100,000. Incorporators, Charles A. North, I. M. Hornbecker and John W. Culbertson.

UNION CITY, IND.—Surveys will be commenced at once for an electric railroad to be built from Winchester to Muncie.

NIAGARA FALLS, N. Y.—The Provincial legislature will be asked to grant a charter for a company to be known as the Ontario and Niagara Electric Railway and Power Company, with power to build an electric railway from Port Dalhousie to St. Catherines and Niagara Falls.

KALAMAZOO, MICH.—W. F. Davidson, of Port Huron, has purchased the Kalamazoo county and city street railway for the General Electric Company, of Chicago. The trolley system will be put in over lines where the cars are now run.

WAYNESBORO, VA.—The project of constructing an electric railway from Waynesboro to Pen Mar is talked of by Baltimore and Waynesboro capitalists.

NEWBURYPORT, MASS.—Nathaniel Dole and others have petitioned for the incorporation of the Essex County Street Railway Company, to operate an electric railway between Newburyport, Hamilton, Rowley and Ipswich. The capital will not exceed $300,000.

WEST CHESTER, PA.—The Citizens' Railway Company, of Chester County; capital $80,000. Incorporators, Thomas Pennypacker, president; William P. Snyder, T. L. Eyre, W. G. Pennypacker and James H. Baldwin,

JERSEY CITY, N. J.—The United Traction and Electric Company; capital $8,000,000. Incorporators, Henry W. Calhoun, of New York; A. H. Larkin, of Nutley, and T. Stallnecht, of Orange. Its objects are the making of contracts or sub-contracts for the purpose of building and equipping railroads, whether operated by horse or electric power. The principle office will be in Jersey City, with branches in New York, Connecticut, Massachusetts, Rhode Island and the District of Columbia.

CLEVELAND, OHIO.—The Fort Washington Electric Company is securing right of way along Willson avenue for a double track street railway from the lake to Broadway. A company, with a capital of $150,000, has been organized.

PEEKSKILL, N. Y.—The Peekskill Surface Railroad Company, whose application for a franchise was granted at the latest meeting of the village board, has been organized with a capital of $50,000.

GETTYSBURG, PA.—E. M. Hoffer, of Hummelstown, has been awarded the contract for the early building of the electric railway at Gettysburg.

AUSTIN, TEX.—The city council has voted to grant a street railway franchise to J. Seyes Haulenbeek, J. F. Harris and their associates.

WASHINGTON, D. C.—The absorption by the Philadelphia Traction Company of the Belt Line Railroad, in Washington, gives the great syndicate desired entrance into the capital for its projected trolley line connecting its Baltimore system.

PERRYSBURG, OHIO.—There is a project on foot to build an electric railway to Perrysburg by way of Maumee.

PLAISTOW, N. H.—The Plaistow and Haverhill Electric Railway Company has been organized.

BRIDGEPORT, CONN.—The Connecticut Telephone, Telegraph and Illuminating Company, capital, $100,000, has been incorporated by John V. Giles, John H. McMahon, Frank Miller and W. H. Stevenson.

MIDDLETOWN, OHIO.—Joseph Iseminger, W. O. Barnitz, Charles Goldman and Geo. C. Jacoby have organized a stock company, with a capital of $100,000, for the purpose of building an electric railway in and around Middletown.

WAUWATOSA, WIS.—A company has been formed to build a new electric railway here. J. P. Schubert, A. C. Dick and August Richter are interested.

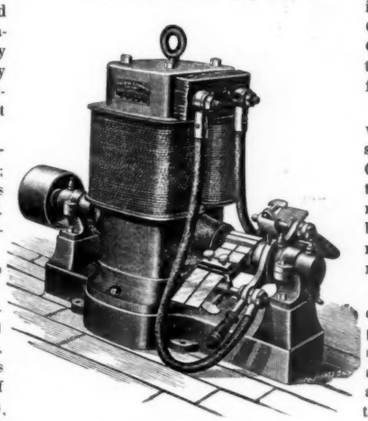
BRISTOL, PA.—Three applications from as many electric railway companies for the franchise of building lines through Bristol have been made to council.

LANCASTER, CONN.—A large electric light plant will be built in the spring on the Connecticut river.

SAN FRANCISCO, CAL.—San Francisco Electric Company has applied for a franchise to light the city. The directors of the company are: Cyrus S. Wright, John F. Meyers, J. R. Gates, Henry E. Monroe and J. Geo. Gardner.

PHILADELPHIA, PA.—Birdsboro Street Railway Company has been organized by G. M. Lewis, H. G. Kulp and P. F. Kelley.

SHAMOKIN, PA.—Shamokin and Elysburg Street Railway Company has been incorporated by E. C. Hamlin, Marlin Markle and C. M. Clement. This company will operate about six miles between Shamokin and Elysburg.



NEW "KING" DYNAMO.

WILKESBARRE, PA.—Wilkesbarre and North Side Street Railway Company. Promoters, Jno. B. Reynolds, C. Butler Reynolds and A. J. Davis.

PHILADELPHIA, PA.—Baltimore Avenue Railway Company. Incorporators, Wm. Jenks Fell, Mahlon M. Child and Wm. I. Kirk.

HARRISBURGH, PA.—Harrisburgh and West Side Electric Railway. Projectors, Chas. B. McKoukey, Valentine Hummel and Geo. B. Butuff.

Electric Light and Power.

LANCASTER, N. H.—The Coos and Grafton Electric Light and Power Company, with a capital of $125,000, has been organized and will establish a plant early in the spring.

SUFFOLK, VA.—The city intends to put in an electric light plant.

NIAGARA FALLS, N. Y.—The Power City Illuminating Company, to manufacture electricity for light, heat and power; capital, $5,000. Directors, H. L. Brewster, H. Hawks, of Rochester; P. A. Porter and Lewis H. Boone, of Niagara Falls.

ST. PAUL, MINN.—The Electrical Engineering and Supply Company has increased its capital from $50,000 to $150,000.

ARCADE, N. Y.—The Arcade village trustees have granted permission to the Fort Wayne Electric Light Company to put in an electric light plant.

The Detroit Dynamo Company's "King" Dynamo.

The Detroit Dynamo Company, of Detroit, Mich., manufactures the "King" dynamo, which is designed for electroplating, electrotyping and copper refining. The old type dynamo made by this company was very successful, over 200 of them being in use in the United States. The machine illustrated herewith is an improved form of the old type. It has self-oiling bearings and a zinc sub-base between the pole pieces and the iron base. The commutator is screwed so that instead of having to return the entire armature to be repaired the user can remove the old commutator and a new one can be sent from the factory and attached in a very few minutes. The "King" dynamo is non-sparking when the brushes are properly set. When used for electrotyping, this machine supplies a current which deposits a good shell in two hours.

ELECTRIC RAILWAY NOTES.

It is reported that the Buffalo and Tonawanda, N. Y., Electric Railroad has been sold to a New York syndicate.

The Main Street Electric Railway in Jacksonville, Fla., will no doubt be running by the time the Sub-Tropical Exposition opens, which will be on February 22. The work is in charge of Mr. B. F. Curtis, who for the past ten years has been with the Thomson-Houston and Consolidated companies.

There is going to be a lively contest for the electric railway franchise in Athol, Mass. Galen C. Moses, of Bath, Me., the millionaire capitalist, who own a controlling interest in the Athol Gas and Electric Light Company, has been in the town with A. F. Gerald, of Fairfield, Me., and the two have taken steps to form a corporation and apply for a franchise.

Judge H. Lynde Harrison, of New Haven, who is counsel in Connecticut for the Thomson-Houston Electric Company and the General Electric Company, denies absolutely the stories that these people are in any manner connected with, or interested in, or backing the schemes for building electric railways parallel with any of the steam railroads in the State.

Testimony was taken recently before the council's sub-committee on railroads appointed in Philadelphia to decide whether an extension of car lines from Thirty-third and Market streets out Woodland avenue and Spruce street should be run by cable or trolley line. The entire testimony showed that the residents all favored the trolley in place of the cable.

The Thomson-Houston Electric Company are said to be behind the movement now before the Connecticut legislature, to secure charter franchises for electric street railways that will connect every town between Bridgeport and Greenwich, Conn. It is claimed that the object of the company is ultimately to connect the various cities in between New York and Boston, and further it is thought that this plan will be accomplished inside of two years.

A charter granted for a trolley line 80 miles long at Harrisburg, Pa., has caused a feeling of alarm among railroad officials. The road is called the Northumberland, Bloomsburg and Scranton Street Railway Company, and connects 39 towns in that region. Among them are Lackawanna, Pittston, Mechanicsville and Nanticoke. It is a very busy center and the establishment of a trolley line will materially interfere with the local traffic of the steam roads.

President Curtis, of the Tramway Company, of Denver, Colo., is deeply interested in the system of distributing mail over the street car lines recently inaugurated in St. Louis. As the tramway lines extend from the post-office to all the principal distributing points in the city, it has been suggested that a mail car might be utilized for the accommodation of all people living at some distance from the central post-office. Denver has grown until the city is too large to depend on one point for the delivery of mail. If the plan is successful in St. Louis, there can be no reason why it could not be put into effect in Denver at an early day.

KINDRED INTERESTS

The Berlin Iron Bridge Company, of East Berlin, Conn., are at work putting up the roof trusses on the new light and power station for the Electric Light and Power Company, at Syracuse, N. Y.

J. W. Parker & Company, Philadelphia representatives of the Ball Engine Company, Erie, Pa., have lately installed a 100 horse power Ball engine at the Bloomsburg Electric Light Company, Bloomsburg, Pa.

The Electrical Engineering and Supply Company, St. Paul, Minn., have sent us a very complete and tastefully printed catalogue of all kinds of electrical supplies. Among the specialties they handle are the National and Eddy dynamos and motors.

The Contract of the Philadelphia Traction Company, which calls for 600 motors and eight 500 horse-power direct connected generators and engines, has just been closed with the Westinghouse Company, and it is stated that the contract will exceed $1,000,000.

Baker & Company, the most widely known platinum importers and refiners, have no cessation of orders these days and their large factory at Newark, N. J., presents a very busy as well as interesting scene. The demand for platinum has largely increased in electrical circles during the past few years, and Baker & Company have, because of reliability and excellence of goods, received nearly all the business.

The Southern Electrical Supply Company, of St. Louis, report very brisk sales of interior conduit and Okonite wire in their territory. The following buildings are the latest to be equipped with the interior conduit system throughout: Rialto building, Mercantile Club, St. Nicholas hotel, Security building, Planters' hotel, Union Trust building, Polytechnic School building. The demand for Okonite wire increases daily. The merits of the Lundell motor are being looked into, and the demand for these machines is on a rapid increase.

An Excellent Way to Utilize the Refuse of Towns.

The deposit of sewage and house dust is one of the most important and usually one of the worst managed of the difficulties with which every town has to deal. If the town is fortunate enough to be on the banks of a river it is almost a certainty that the river will be converted into an open sewer. If there be no river the refuse will be dumped on some vacant plat, generally in the neighborhood of dwelling houses, and always near enough to affect the health of the inhabitants. The annual estimated amount of "sludge" to a town with a population of 50,000 is, exclusive of surface water, slop water and manufacturers' refuse, over 25,000 tons. The enormous refuse of large towns can now be handled and utilized by the use of the destructor with the greatest ease, to the great benefit of the health of the population and the coffers of the municipality. The refuse is emptied into a number of cells, and by a wave-like motion is gradually moved forward over the furnace. All the moisture and impurities are thus removed and the dry product can be used for a variety of purposes. The temperature of combustion is over 2,000 degrees Fahrenheit, and this intense heat, when applied to raising steam or generating electricity, renders sufficient power available to more than repay the cost of both collection and burning. This question is being much discussed in England, where electrical and borough engineers are earnestly canvassing the merits of the latest modifications of the destructor. A company has been formed for contracting to supply electric light derived from the dust refuse of towns. The company claim that 20,000 tons of house dust, if treated as they suggest and burnt in suitable boilers, might be made to produce as much as 56,000,000 indicated horse-power hours, equal to an engine of 1,183 indicated horse-power working for 4,734 hours, for electric lighting.

Clamond's Microphone and the Berliner Transmitter.

To the Editor of Electrical Review:

Sir—Referring to a recent issue of your valued journal, containing an interesting description of Clamond's microphone, stated by Mr. Clemenceau to embody a new principle, I make free to send you a discussion of the principal claims of Clamond's United States patent (No. 486,244, granted November 15, 1892), which, I trust, will be of interest to the readers of the Electrical Review.

As Mr. Clemenceau expresses the opinion that Clamond's construction escapes the United States patent of Berliner, granted November 17, 1891, a comparison between the claims of these patents may be useful, and enable those who are not versed in patent lore (for which they may thank Heaven) to see at a glance the points of similarity or dissimilarity in the wording of the respective claims. The claims are as follows:

Berliner, 463,569, *November* 17, 1891.	*Clamond*, 486,244, *November* 15, 1892.
Claim 1. The method of producing in a circuit electrical undulations similar in form to sound waves, by causing the sound waves to vary the pressure between electrodes in *constant contact*, so as to strengthen and weaken the contact, and thereby increase and diminish the resistance of the circuit.	. . . by causing said sounds to *vary* the cross-section and length and corresponding electrical resistance of an electrical conductor included in a charged electric circuit.
	2. A telephonic transmitter, comprising two electrodes at a *distance* from each other, and a plastic, viscid conducting body maintained in *invariable contact* with the two electrodes.

Berliner: Electrodes in constant contact.

Clamond: Electrodes at a distance connected by a plastic medium maintained in invariable contact.

It is at once apparent that Clamond's method is subordinate to Berliner's first claim, for the following reasons: Berliner claims electrodes in constant contact, but not mechanically connected. A layer of air (a plastic, viscid conducting body, its conductivity depending upon the intensity of the current) necessarily intervenes between the two electrodes, yet this air cushion is *not mechanically* connected with the two electrodes. This point, however, is of minor importance.

Berliner claims that by mechanical pressure between electrodes in constant contact (the number of electrodes is not stated) their contact is varied, thereby varying the electrical condition of the circuit.

Looking at Clamond's first claim, we find that by mechanical pressure (the impact of the sound waves) the form of an electrical conductor included in an electrical circuit is changed, or, in his own words, "the microphonic element becomes elongated" and "the microphonic element becomes thicker." According to Berliner, by mechanical pressure between electrodes in constant contact their contact is varied. Varying contact by pressure means a change in the form of the electrical conductor, no matter how slight or infinitesimal such change may be; indeed, this phenomenon is a "*conditio sine qua non*" underlying the electrical reproduction of sound by battery transmitters. Mr. J. R. Paddock's experiments (English *Electrical Review*, volume xxi, page 486, *et seq*, November 11, 1887) show that with two carbon blocks in contact, the mechanical pressure between them, produced by turning a micrometer screw (abutting against the upper carbon) by $\frac{1}{1000}$ of an inch, the resistance fell from 24,000 ohms to 16 ohms; in other words, by an infinitesimal change in the form of the electrodes (for a pressure necessitates a yielding of the substance upon which a pressure is exercised), by approaching them the $\frac{1}{1000}$ of an inch, a tremendous change in their electrical condition is produced.

But Mr. Clamond claims: 1. Mechanical contact of a plastic conducting body with two electrodes. 2. The plastic material maintained in invariable contact with the two electrodes.

As to the first point: A study of prior patents shows that this claim is fully anticipated. United States patent 308,956, December 9, 1884, W. H. Eckert, states: "My invention has for its object to obtain a vibratory contact between surfaces which are covered or impregnated with particles of conducting material whereby wide variations of electrical resistance may be effected under the influence of sound vibrations, while at the same time permanency of adjustment is attained. To this end I employ two sheets of metallic foil, forming both electrode plates and a diaphragm suspended side by side in contact with each other and below the mouthpiece of the transmitter. The contact surfaces of the foils are coated with an adhesive gummy substance which is impregnated with fragments or particles of a conducting material which, when dried, forms a hard and *elastic* body."

Evidently Eckert's apparatus has Clamond's "two electrodes" at a distance from each other, and a plastic (the patentee says elastic) conducting body maintained (if you will) in invariable contact with the two electrodes. There may yet be a doubt as to the *mechanical* invariable contact feature. Even this point is old. It is sufficient to call attention to the well known Cuttriss carbon spiral transmitter, in which the spiral is in mechanical *permanent* (permanently cemented to the diaphragm) contact with the two electrodes, *i. e.*, the diaphragm and the regulating screw.

2. As to the second point: The plastic material maintained in "invariable contact" with the two electrodes. We must first of all define the meaning of the phrase "invariable contact." It may stand for a mechanical or electrical, invariable contact. If the latter, we know that upon the change in the electrical condition of the electrodes and any other material forming an electrical connection between them is based the microphonic effect. If the contact between such an intervening substance and the electrodes remains unchanged, no sound is heard in the receiver. Consequently, Clamond's invariable contact must refer to the mechanical stability of the intervening substance.

Let us see whether such a claim can be sustained. Clamond describes the physical phenomenon by which the microphonic effect is produced in the following language: "The resistance changer being pasty, adheres at each end to one of the electrodes, and if one of these electrodes moves axially toward or from the other, the shape of the resistance changer changes." Replacing the resistance changer by a rubber band, attached at both ends firmly to movable wooden blocks, it is evident that any outward excursion of one of the blocks stretches or elongates the rubber. But as it elongates, the number of rubber molecules in contact with the wooden block is clearly diminished, and the shape of each molecule at its contact surface changed. In other words, although rubber and wood are in mechanical contact, yet a stress or pull applied axially to one of the two substances requires a molecular change at their contact surface, and thus the entire invariable contact theory of Clamond becomes null and void, being contradicted by the physical law which teaches that a stress or pull exerted at the end of a plastic body produces the greatest molecular charge at that point.

The logical conclusion, then, would be that Clamond's claim is void, because it is based upon a physical condition of matter contradicted by human knowledge.

A Careful Reader.

New York, February 18, 1893.

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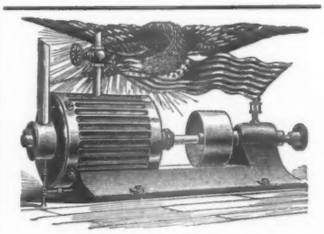

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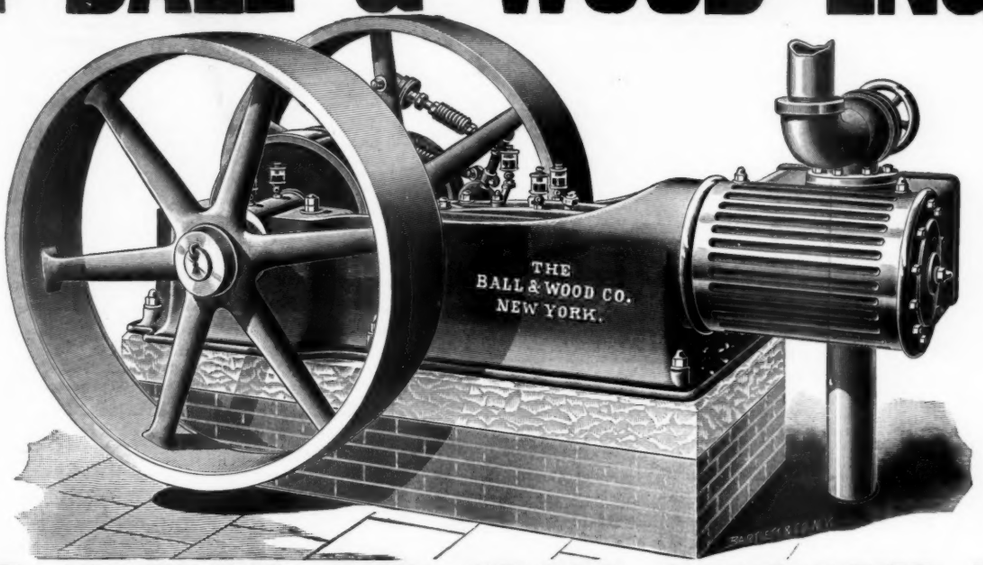

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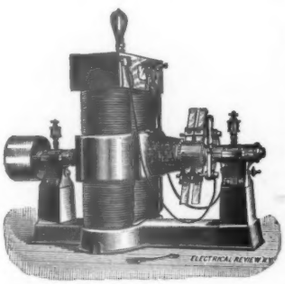

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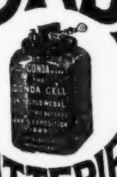

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ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON FEBRUARY 28, 1893.

491,978 Workman's time recorder; Frank H. Bolte, Milwaukee, Wis., assignor of two-thirds to Parker H. Lercombe and Thomas A. Donlevy, same place.

491,982 Electric motor and controlling apparatus for cars; John V. Capek, New York, N. Y., assignor of one-half to Edward H. Johnson, same place.

491,988 Electric railway trolley; Alfred Dickinson, Darlaston, England.

491,990 Multipolar dynamo-electric machine armature; George E. Dorman, Chicago, Ill.

491,992 Cut out for incandescent electric lamps.

491,993 Stop device; Thomas A. Edison, Llewellyn Park, N. J.

492,003 Manufacture of chlorates of the alkaline metals and metals of the alkaline earths; Henry Gall, Hermes (Oise), and Amaury de Villardy de Montlaur, Paris, France.

492,008 Pole standard for arc lamps; Frederick D'A. Goold, Schenectady, assignor to the Edison General Electric Co., New York, N. Y.

492,011 Electrical indicator; Henry J. Haight, New York, N. Y.

492,019 Magnetic telephone switch; Wm. Hermans, Cambridge, Mass., assignor to the American Magnetic Electric Co., Jersey City, N. J.

492,036 Automatic circuit breaker for motors; Robert T. Lozier, New York, N. Y., assignor to the Edison General Electric Co., same place.

492,106 Conduit railway; Frank B. Rae, Detroit, Mich., assignor to the Detroit Electrical Works, same place.

492,110 Automatic individual telephone call apparatus; Joseph Sack, Berlin, Germany.

492,124 Duplex electric arc lamp; Barton B. Ward, New York, N. Y.

492,150 Process of coating conductors for incandescent lamps; Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Co., New York, N. Y.

492,151 Dynamo-electric machine; Wallace B. Freeman, Long Island City, assignor to Lawrence M. Close, New York, N. Y.

492,160 Electric elevator; Frank E. Herdman, Indianapolis, Ind.

492,176 Commutator for dynamos or motors; Joseph A. Williams, Cleveland, O.

492,200 492,201 Electric arc lamp; Henry Harper, London, England, assignor to himself, John Tryon and Thomas George Poole, same place.

492,215 Hanger for electric incandescent lamps; Samuel O. Larkins, Blair, Neb.

492,219 Lightning conductor and arrester; Adelbert B. Lyman, Cleveland, O.

492,244 Method of constructing armature cores for electric motors or dynamos; Albert W. Smith, San Francisco, Cal.

492,245 Magnetic tool; Jacob F. Standiford, Muscogee, Ind. Ter.

492,247 Electrical foot warmer; Wm. E. Ulmer, Hoquiam, Wash.

492,265 Conduit electric railway; Fred. W. Brann, Oakland, Cal.

492,274 Street car motor; James A. Currie, Springfield, O.

492,291 Commutating apparatus for dynamo-electric machines; Edward J. Houghton and Wm. White, London, England.

492,301 Coupling for trolley wires; William H. Keckeley, Covington, Ky.

492,309 Electric bell alarm; Gustaf L. Reenstierna, Boston, Mass.

492,312 Electric arc lamp; John Thompson, New York, N. Y.

492,340 Electric burglar alarm; Julius Kamsler, New York, N. Y.

492,355 Magnetic core for armatures; Thomas H. Hicks, Detroit, Mich.

492,377 Electric reduction of refractory metallic compounds; Thomas L. Willson, Leaksville, N. C.

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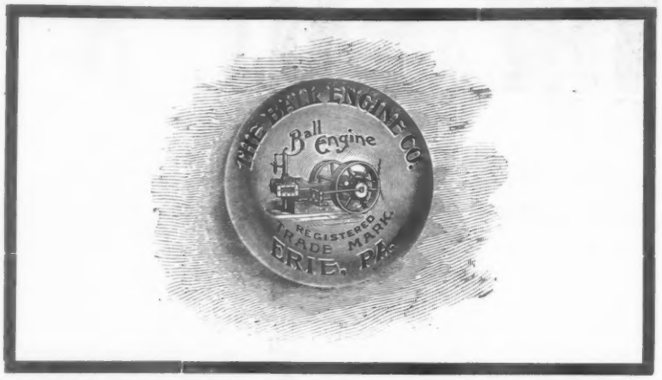

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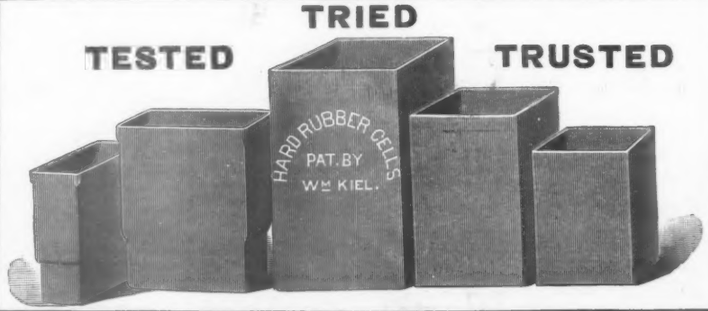

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